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Factory Sense

There has recently been reported a fatal accident through a man being shut in a large core stove. Correspondents have written suggesting measures for eliminating such occurrences in the future. Yet, as far as we know—and this is after some investigation—this is the first time such an accident has occurred in this country. During the 1914 war, in a South European foundry where we were working, there was a similar happening. This concern, like many others, had greatly increased its staff in order to meet its commitments in the war effort and was using a quantity of untrained rural labour. Apart from this, there were during the same week two other accidents—one of which was fatal. This was a case of a ladle with two tapping nozzles, one of which was "glued up." While a man was beneath the ladle poking at the obstruction, the second hole was opened and the man received the stream of liquid steel in the middle of his back. The third accident, happily not too serious, related to the fracturing of a box-like casting to ascertain its soundness. It was obvious to us on happening to catch sight of the set up, that on impact with the sledge hammer, a component of the casting would fly up and hit one of the men holding the job with a pair of tongs. We did our best to avert the accident—which resulted in a bad cut on the forehead—but we were a fraction of a second too late.

We have related these circumstances because for over thirty years we have been stating that such accidents could not occur in this country because of an inherent factory sense. Now one of them—that of the imprisonment in a core stove—has occurred, after three hundred years of foundry practice, and suggestions are being put forward for the future minimisation of the liability. Surely there should be no need to make special provision against a recurrence. The inborn factory sense should be sufficient to rule out such happenings, especially since "factory sense" has long been reinforced by "safety first" precepts. If special precautions are to be created for such occurrences then industry would tend to be overwhelmed with too many gadgets and notices and the sense of proportion would be lost and more, not fewer, accidents would be reported.

It is incumbent on every member of the foundry industry personally to exercise a measure of common sense so as to avoid either personal injury or accidents to one's mates. In industry, risks have to be taken, as in every other walk of life, but these risks should be taken objectively and intelligently. If the risks are of too-frequent occurrence, then steps should be taken for their elimination by better methods. It is not the isolated headline-making accident which needs intensive study, but rather those constantly-occurring and sometimes equally serious mishaps resulting from "falling bodies" and "tripping-up" and the like. Unless accidents from the former cause can be materially lessened, the introduction of "hard" hats such as are currently used in the great alkali works might be introduced. Unintentionally, we have up to now only received spots of oil, but horse-play—another prolific source of industrial accident—has been responsible for our bespattering with clods of "patching" and the like. We have, after much foreign experience, always assured ourselves that, in this country, factory sense is particularly highly developed and the recent lapses one must ascribe to the intensive recruitment. We devoutly hope that this period of instability is passing and that reliant factory sense will again reign supreme.

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Presentation to Mr. D. H. Wood

At a luncheon of the Council before the 8th Annual General Meeting of the Council of Ironfoundry Associations, a presentation was made to Mr. D. H. Wood, in recognition of his work as chairman of the West Midland Foundry Advisory Committee (Recruitment and Training), when the training centre was being set up in West Bromwich. Mr. J. W. Gardom recalled that the C.F.A. had recommended, in January, 1948, that group training centres should be established in three foundry districts. Mr. Wood took up the challenge on behalf of Birmingham, and the West Bromwich centre was officially opened on September 26, 1948, at the works of Rudge Littley, Limited. Since that time, this West Midland centre became accepted as the national centre, and was now flourishing as the National Foundry Craft Training Centre. As chairman of the training committee, Mr. Gardom expressed the C.F.A.'s gratitude for the vast amount of work which Mr. Wood had carried out for the Centre, and for his generosity in providing it with a great deal of equipment on permanent loan. Mr. Wood had been compelled by reasons of health, to relinquish the chairmanship of the West Midland Committee, but he would feel some recompense for his work in knowing that a hundred students had already passed through the Centre and this training would bear fruit for the industry.

The Chairman then presented Mr. Wood with a plaque, cast in iron, which reproduced a head and shoulders portrait of Mr. Wood modelled in relief. (This plaque had been generously provided by Mr. C. C. Booth and had been executed in his foundry).

Mr. Wood expressed his appreciation of the kindness of the C.F.A. in so honouring him, and said he would greatly value the plaque they had presented to him. He asked the Chairman to accept a copy of the colour film of the opening ceremony at the Training Centre. This film was gratefully received by the Chairman.

Latest Foundry Statistics

The February issue of the Statistical Bulletin published by the British Iron and Steel Federation reports that the total number of persons engaged in ironfounding on January 7, 1950, was 145,790, or 562 fewer than a month earlier. It is interesting to note that of this reduction, 263 were female and 299 were male. Steel founding, too, suffered a reduction of exactly 100, actually 19,415 to 18,415. In this case there were 69 fewer men. The weekly average production of liquid metal for steel castings during January remained unchanged at 8,400 tons, of which 1,620 tons were alloyed. The average weekly deliveries of actual castings during January was 4,300 tons.

MR. GEORGE INGLIS, foreman patternmaker of the Melville-Brodie Engineering Company, Sinclairtown Foundry, Kirkcaldy, has been presented by his fellow workers with a gold wrist watch suitably inscribed.

THREE TYPES of small, vertical "Petter" diesel engine, the "AV," "AVA," and the "B," will be shown at the British Automobile and Motor Cycle Show which opens in New York on April 15. These light-weight type engines are used by the building trade to power cement mixers, hoists, pumps, cranes, loaders, etc., and for agricultural use. The engines of these types on show are all equipped with a half-speed extension shaft giving the rated output at half the normal engine speed. A marine version of the "AV," the "AV2M," and the traction "B" type, the "B4T," will also be shown.

Forthcoming Events

MARCH 21.

Institute of British Foundrymen.

Burnley Section:—Annual General Meeting, followed by "Non-ferrous Founding," by T. Freeman, at the Mechanics Institute, Manchester Road, Burnley, at 7.30 p.m.

Slough Section:—Annual General Meeting, followed by "Plain Bearings—Materials, Design and Fitting," by P. T. Holligan, D.F.C., B.Sc.Tech., F.I.M., at the Lecture Theatre, High Duty Alloys, Limited, Slough, at 7 p.m.

Chemical Engineering Group.

"Cost Estimating in Process Development," by H. W. Ashton and G. T. Meiklejohn, at the Geological Society, Burlington House, Piccadilly, London, W.1, at 5.30 p.m.

MARCH 23.

Institution of Production Engineers.

London Section:—"The Effective Use and Selection of Materials," by Dr. R. Genders, M.B.E., D.Met., F.R.I.C., F.I.M., at the Royal Empire Society, Northumberland Avenue, London, W.C.2, at 7 p.m.

MARCH 24.

Institute of British Foundrymen.

London Branch:—Men-only Dinner, at Londonderry House, Park Lane, London, W.1, at 7 p.m.

Institution of Mechanical Engineers.

"The Full Application of Motion Study," by Miss Anne G. Shaw, M.A., at Storey's Gate, St. James's Park, London, S.W.1, at 5.30 p.m.

Keighley Association of Engineers.

"The Production of High-quality Steel," by J. J. P. MacKenzie, B.Sc., M.I.Mech.E., at Devonshire Buildings, Devonshire Street, Keighley, at 7.30 p.m.

MARCH 25.

Institute of British Foundrymen.

Wales and Monmouth Branch:—"The Production of Castings for Internal-combustion Engines," by H. Haynes and C. R. van der Ben, at the Engineers' Institute, Cardiff, at 6 p.m.

AS FROM March 25 the address of the National Institute of Industrial Psychology will be 14, Welbeck Street, London, W.1, telephone: Welbeck 1144.

FUEL RESEARCH SURVEY PAPER NO. 50, entitled "Improved methods for the quantitative analysis of coal ash and coke ash," has recently been published by H.M. Stationery Office, price 1s.

MR. WALTER TOM SMITH, of Scarborough, died recently at the age of 73. Mr. Smith was one of the original members of the engineering firm of Thomas Smith & Sons (Rodley), Limited, crane and excavator works, Rodley, near Leeds, and served as a director up to his retirement nine years ago.

THE ANNUAL GENERAL MEETING of the Manchester Association of Engineers will be held to-morrow at the Engineers' Club, Albert Square, Manchester, commencing at 6.30 p.m. An ordinary meeting of the Association, at which Mr. J. A. Walker will present a Paper entitled "Works Information and its Effect on Production," will follow the annual general meeting, and the proceedings will close with the induction of the new president, Mr. J. Adamson.

The Index to the FOUNDRY TRADE JOURNAL, Volume 87, July to December, 1949, is now available free of charge on writing to the JOURNAL Publishing Office at 49, Wellington Street, London, W.C.2.

Roller Conveyors and Fittings

By "Argus"

There are many features of roller-conveyor systems that present problems, the solution of which may be found by experience, or in a less costly manner, from the experience of other users of this type of equipment. The plant illustrated in Fig. 1 has had a rather peculiar history. It is really an amalgamation of two plants, one for dry-sand and one for green-sand, which had operated in two separate foundries, each plant being equipped with roller conveyors. In its present form, much of the experience gained in the previous layouts has been incorporated.

The two D-shaped loops are for green-sand moulding production, one for boxes of 34 in. by 22 in. and the other 44 in. by 30 in. inside, and other miscellaneous smaller boxes. They are typical of many installations employing jolt machines working in pairs. One machine delivers the "drag" mould on to the outer track which is continuous to the knock-out, while the other delivers the "cope" on to a short length of straight track inside the loop. Despite the many attractive features of roller tracks, among which might be listed low first-cost and ease of installation, ability to produce line flow from irregular mould supply, etc., this form of conveyor is less attractive from the point of view of freedom from irregular and unwanted movement than either pendulum or plate conveyors. From the quality angle, it is obvious that nothing can be as good for a mould as setting it on the floor. Any movement at all is from the quality factor to some degree negative. Next in desirability is constant, regular, motion as in the driven types of conveyors.

Limitations of Roller Conveyors

On rollers, the moulds can suffer from sudden acceleration and slowing, from fast motion round bends, and from bumping. In the vertical plane they can be affected by irregularity in height of the rollers and equally by irregularity of the carriers or bottom boards. If there is no gradient in the track, the first four of these can only be caused by the personnel handling the moulds. Large-radius bends help to reduce centrifugal effects and also leave the mould reasonably well in line with the track. With a small radius, the moulds tend to lie slewed round to some extent after the bend and require a considerable amount of man-handling to get them back or else the fitting of a mechanical manipulator. Except in the case of track of super quality, with rollers machined or ground true to their spindles, the tops of the rollers do not present a level surface to run the moulds along.

The sum of all these shortcomings is most clearly demonstrated in the shifting tendencies of runner and head boxes, commonly experienced where there is much movement of moulds. It is for this reason that the moulds shown in Fig. 2 have the runner basins in the mould itself, these being formed by an aluminium pattern of the basin with a hole through it, to let it ride down the gate pin when jolted.

Mould Carriers

In the plant illustrated, the first mould carriers were metal-bound wooden boards. Some of the few still in use are shown at the left in Fig. 2. These boards have light-metal runner straps underneath and the transverse lay of the wood allows them to adapt themselves to the surface of the rollers fairly well under the 2-ton weight of the mould. The cost of upkeep of boards, however, is very heavy owing to burning, mainly from moulds vents. Another undesirable factor found with boards is that the flat surface against the mould can retard the escape of vent gas from a hole driven through by wire from the joint face.

After various trials, the aluminium carrier, designed as shown at extreme left in Fig. 3 (also under moulds at right in Fig. 2 and inverted in Fig. 4) was brought into service. It weighs only 60 lb. for its 6 sq. ft. area and is laid on the mould, while the latter is on the jolter, by one man. The wash-board top is formed to simplify the escape of vent gases from the heavily-cored moulds. The runners are of soft wood to allow uneven rollers to bed themselves in, as the carrier passes, whilst they are not wide enough to create severe drag when passing round the bends. As these carriers are not strong enough to take the bending force imposed by the Pneulec air clamps, arrangements had to be made to relieve them

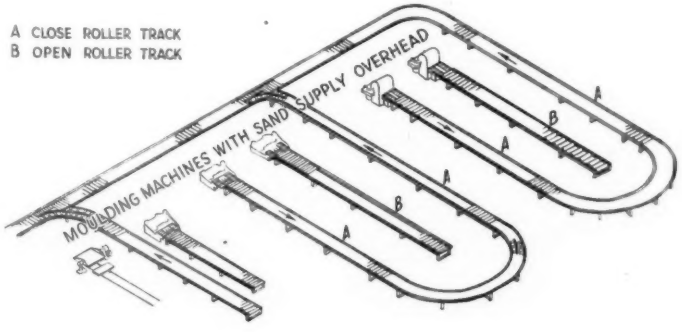

FIG. 1.—GREEN-SAND MOULDING PLANT UTILISING TWO D-SHAPED ROLLER-CONVEYOR LOOPS.

FIG. 2.—CORING AND CLOSING OF MOULDS ON ROLLER CONVEYORS. NOTE: MOULDS WITH RUNNER BASINS FORMED INTEGRALLY IN THE TOP PARTS.

of this form of load. It is essential for most of the work that the carrier should be bedded on to the mould, otherwise it might have been put on the draw table to receive the mould.

A steel section weighing only 16 lb. was formed of a 3-in. by 1½-in. channel and fitted with an end plate to take the finger of the clamp, as shown in Fig. 4. These are made to the maximum length that can be accommodated between the clamp posts of the machine and, therefore, never require moving for any change of box. The channel can easily be pulled out as the mould is lowered.

Other Accessories

Other fittings which were designed and made specially for the plant included two sets of roll-over points of a design based on smaller sets seen some time previously in another foundry. Being much larger than the originals, the new ones were fitted with worm-wheel turning gear. These points took the place of a vertical-axis turntable of the swinging-bridge type in one of the plants incorporated in the present unit, and a lowering inter-roller "T" junction in the other. The present roll-over gear is much superior, since any number of moulds can be pushed over it without operating the mechanism for each individual mould as was required with the previous devices.

Air-operated manipulators, as shown in Fig. 5, were made for the purpose of changing the position of moulds delivered cross-wise on to the track, to a position in line with it. To do this, the mould was set over the ring which lifted it clear of the rollers by action of the compressed-air cylinder below. The mould could then be swung round to any desired position, *e.g.*, that suitable for pouring, and lowered to the track again; no rollers lifted with the ring. These fittings are not included in the present layout, since the machines now in use can deliver the moulds in either direction as desired.

(*Continued on page* 280)

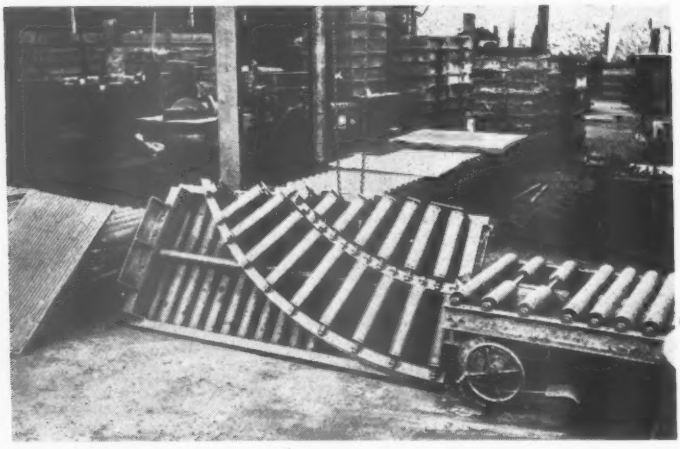

FIG. 3.—VARIOUS SECTIONS OF ROLLER CONVEYOR. A CAST-ALUMINIUM CARRIER IS SHOWN ON EXTREME LEFT.

Mechanised Production of Light Castings

By A. Graham Thomson

Scarcity of skilled labour and pressure on available floor space led Wilmer Lea Foundries, Limited, Bow Bridge Ironfoundry, High Street, London, E.15, to consider the possibilities of mechanisation as a means of increasing production. The company's output included a wide range of iron castings for builders, comparatively simple to mould, which were being supplied in large enough quantities to warrant the introduction of mechanical methods of production. It was therefore decided to mechanise one of the existing shops.

The plant was designed and installed by Stone-Wallwork, Limited, who had to approach the problem largely from the standpoint of the space available within the four walls of the shop. The foundry floor was essentially rectangular, 94 by 82 ft., except for a corner piece about 30 ft. square; this size and shape limited both the design of the plant and the possible length of cooling conveyor track. Very careful attention had therefore to be given to the location of individual units, and this has resulted in a very compact plant, providing an interesting example of the conversion of a jobbing foundry to the mechanised production of small castings. A notable feature is the absence of any motorised mould conveyor, the moulds being handled by roller-track conveyor throughout the plant.

The sand-treatment and distribution plant is close to two of the walls, leaving the maximum amount of floor

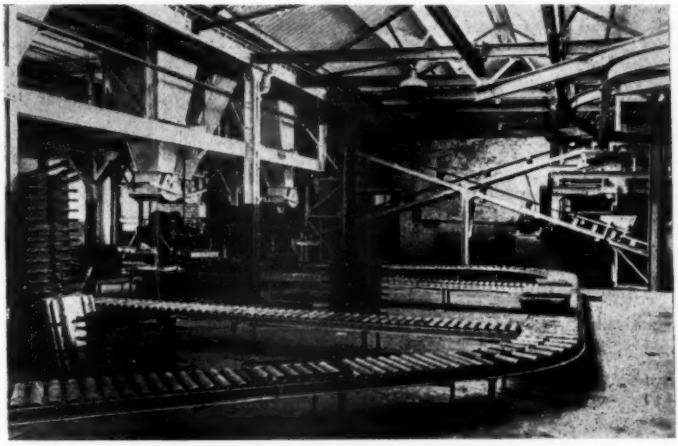

FIG. 1.—GENERAL VIEW OF THE FOUNDRY LOOKING TOWARDS THE SAND MILL (RIGHT-HAND SIDE.)

In the extreme background is the sand-supply belt to the mill, and adjacent to this belt and running crosswise is the delivery sand conveyor to the belt serving the machine hoppers. On the left are the moulding machines.

FIG. 2.—VIEW OF PLANT LOOKING TOWARDS THE MOULDING MACHINES AND THE KNOCK-OUT. TWO OF THE CROSS TRACKS ARE SHOWN IN THE FOREGROUND.

Light Iron Castings Production

space for production. There is a continuous mill for ordinary-sand treatment and a separate batch mill for facing-sand treatment. The main sand-storage hopper has a capacity of 40 tons and is located in a corner of the building. Sand from this hopper is brought by an inclined belt to the continuous mill (Fig. 1). After treatment it travels up a second inclined belt and thence along the main distributing belt, which feeds hoppers located above the moulding machines and also the batch mill.

Moulding Plant

There are three pairs of moulding machines (Fig. 2), each pair being operated by a team of three men, two members operating the machines while the third assists with the removal of the finished mould and also carries out the coring and closing operations. The drag-half of the box is made on either a turn-over or a straight-draw machine, depending largely on the intricacy of the casting and, at the same time, the cope half is moulded on a straight-draw machine (Fig. 3). After the half-moulds have been produced, the in-gates are cut on the same machines. The half-moulds are placed on cross roller tracks and cored up (if any cores are required). The box is then closed and pushed on to the main pouring track.

Pouring is continuous and is done from geared ladles conveyed by means of an overhead mono-rail system; the rated capacity of the foundry's two cupolas is two tons per hour. After pouring, the boxes are fed towards the knock-out section and travel along some 100 ft. of cooling track, which brings them gradually to the knock-out point. A vibratory unit then knocks out and riddles the sand, which falls through a grid into an underground pit. The castings are put into stillages and removed for fettling, while the empty box parts return by gravity to the moulding machines (Fig. 4). The hot sand from the knock-out travels up an inclined belt, which carries it beneath an over-band magnetic separator to remove all pieces of scrap and feeds it back to the 40-ton storage hopper. The moisture content and permeability of the sand are checked at frequent intervals in a testing plant located close at hand.

Working Conditions

To provide satisfactory working conditions, a dust-extractor hood is located at the knock-out point and a fume extractor has been installed in the pit below. Due to the efficiency of the extraction systems, the atmosphere of the foundry remains very clear. As a result of the limited overhead space, however, the central in-

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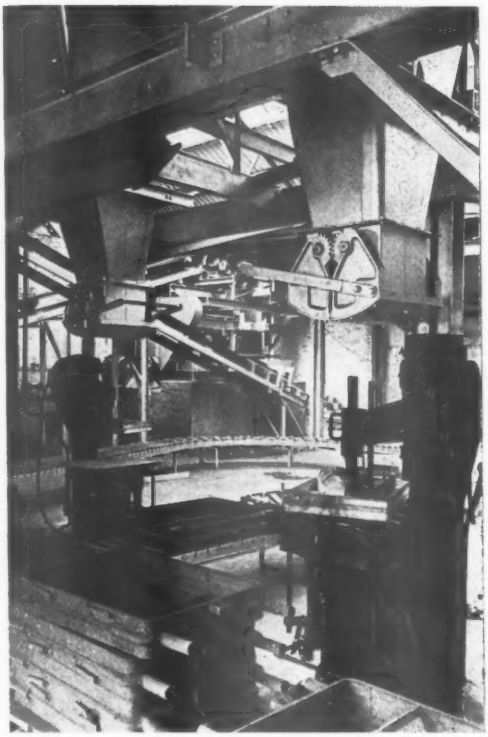


FIG. 3.—A PAIR OF STRAIGHT-DRAW MOULDING MACHINES OPERATING UNDER DUPLEX GATE HOPPERS.

FIG. 4.—REAR OF PLANT, SHOWING COOLING SECTION AND BOX RETURN ON GRAVITY ROLLER TRACKS.

Iron and Steel in India

In a Paper on developments in the Indian iron and steel industry, which Mr. E. V. Parkinson, B.Met., F.I.M. (technical adviser, Tata, Limited), read before the Royal Society of Arts last Thursday, the Author made the following references pertinent to the foundry industry:—

Pig-iron and Iron Castings

Pig iron is produced by four concerns. The Tata Iron & Steel Company, the Indian Iron & Steel Company, and the Bengal Iron Company (which were amalgamated in 1935), and the Mysore Iron Company. There has been an increase in blast-furnace capacity through redesigned and larger modern furnaces. Tata's have five furnaces, producing about 1¼ million tons per annum. The Bengal Iron Company operate two modern furnaces, each with a capacity of 400/500 tons per day. The Indian Iron & Steel Company have two similar furnaces of about 800 tons per day each. Prior to the war, the Mysore Iron Company increased the capacity of its charcoal blast furnace from 40 to 80 tons per day. The present operating capacity of India's iron industry is just over 2 million tons per annum, of which approximately 63 per cent. is with Tata's and 35 per cent. with the Indian Iron & Steel Company, Limited.

Associated with the blast furnaces of the old Bengal Iron Company at Kulti, are the largest and most modern iron foundries in the country, with a capacity of about 65,000 tons per annum, and specialising in the production of cast-iron pipes, vertically and centrifugally cast, and of sleepers for the railways.

India's consumption of pig iron, apart from that required for steel making, had remained fairly static from 1931 to 1939, being about 130,000 tons per annum. About half this was used for the production of railway sleepers and about 25,000 tons for the production of pipes and fittings. With the visualised increased requirements in the future, it is estimated that the total foundry demand will be about 300,000 tons, and with the anticipated expansion in the production of steel, it can be expected that the exportable surplus of pig iron will decrease.

Steel Castings

In pre-war years the steel-castings industry, mainly located in Bengal, was subjected to considerable competition from cheap castings from the European continent. Its capacity was considerably augmented during the war by new foundries erected in Calcutta, Cawnpore, Bombay and Mysore. Individually, they were not large. Production increased from about 2,500 tons in 1936 to over 8,000 tons in 1943, and the capacity now probably exceeds 14,000 tons per annum. More than 60 per cent. of present production is absorbed by the railways. In the absence of any considerable secondary and constructional industries, production has been chiefly for the repair and maintenance of existing equipment.

Of the smaller firms producing steel for castings, a few operate rolling mills. The Bhartia Electric Steel Company and the National Iron & Steel Company in Calcutta, the Mukand Iron & Steel Company in Bombay, and the J.K. Iron & Steel Company in Cawnpore, together have an electric and open-hearth steel-melting capacity of some 40,000 tons and a mill capacity of about 120,000 tons per annum. Their products are bars and castings. To develop further the production of special carbon and alloy steels first commenced during the war, they have jointly formed the Indian Special Steels Marketing Board. The Hume Pipe Company in Bombay and the Singh Engineering Company of Cawnpore have small steel-melting furnaces and roll bars.

Government Ordnance Factories

There are three Government ordnance factories: one at Ishapore, near Calcutta, one at Cawnpore, and the other at Muradanagar, near Meerut. The last two were established during the recent war, the former being somewhat incomplete and the latter essentially a steel foundry. Their production is primarily of a specialised nature to meet Service requirements. The Ishapore plant has two small acid open-hearth furnaces, producing some 24,000 tons of ingots per annum and two 2-ton electric-arc furnaces for special steels. It operates a blooming mill and a rod mill in addition to forging presses, etc. Some cold drawn steel is produced.

General Conclusions

It is reasonable to conclude that with the vast natural resources available, the huge potential market, the declared policy of industrialisation, and the fundamental importance of this basic industry to the success of such plans, the future of the Indian iron and steel industry is particularly encouraging. Although her geographical location and comparatively low costs of producing iron and steel give her a predominant position as a possible exporter of iron and steel products, India's own immediate and future demands will not permit any large quantities being available for export in the near future. Moreover, it may be that the limitations imposed by the inadequacy of her known resources of coking coals may prevent the development of the industry to a scale comparable with those of the countries of the West.

Mechanised Production of Light Castings

(*Continued from page* 278)

stallations tend to shut off the light and fluorescent lighting has therefore been installed over the entire production section of the plant.

Present output is averaging about eight tons a day of finished castings. In favourable circumstances this tonnage might be appreciably exceeded. The size of the castings handled is limited by the length of cooling track, current production comprising builders' castings from 1 lb. to 15 lb. and exceptionally up to 28 lb., as well as a small proportion of engineering castings. Mechanisation has enabled the company to produce quality castings by labour which is very largely unskilled or semi-skilled, and output has been substantially expanded without structural alterations to the existing premises. Experience is showing, however, that to achieve an output commensurate with the potential capacity of the plant, it is not only necessary to have the right materials and the right men on the machines, but also to provide the right type of incentives for the men. The production of simple castings has averaged 440 to 450 complete moulds per day per pair of machines. The plant is a good example of flexibility and increased production within a confined space.

MR. JAMES CLAY, who died last Monday at the age of 83, was a director of the agricultural section of James Clay (Wellington), Limited, Wrekin Foundry, Ketley, a business which he started in 1907, in association with Mr. T. Offley Lander. Mr. Clay was noted for his work in developing and improving a number of agricultural implements, and worked on oil engines when they were regarded as "new-fangled contraptions."

Roller Conveyors and Fittings

(*Continued from page* 276)

In the roller layout immediately previous to that illustrated in Fig. 1, over a period of about three years, the moulds were poured while on the swing-bridge type of turntable. Whilst this allowed the ladle to remain practically stationary, it involved the moving of moulds while the metal remained liquid. As a turntable of this

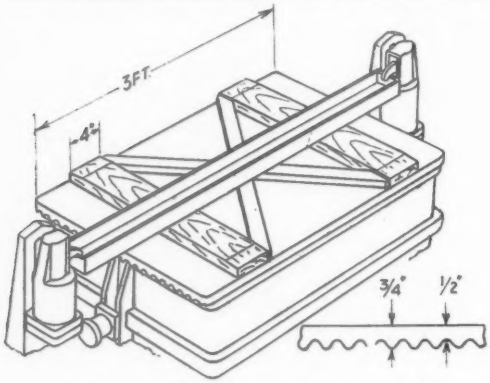


FIG. 4.—ARRANGEMENT OF ALUMINIUM MOULD CARRIER WITH A STEEL CHANNEL SECTION FOR TAKING THE PNEULEC AIR CLAMPS.

type is very difficult to maintain in perfect level with the adjoining parts under all conditions of loading, the moulds sometimes got quite a noticeable jolt, and evidence of this could be seen on the castings by the occurrence of a two-ply fin at the joint, which was very puzzling until the cause was discovered. Under present

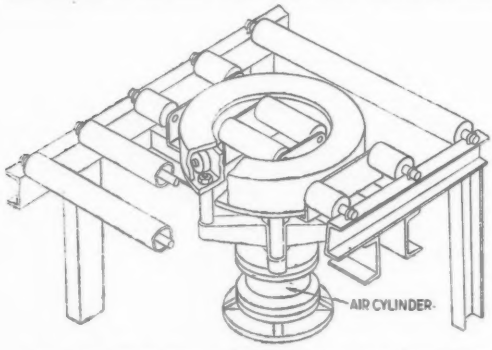


FIG. 5.—AIR-OPERATED MANIPULATOR FOR ADJUSTING MOULDS ON ROLLER TRACK.

arrangements, neither the cored mould nor the mould with liquid metal in it passes over any movable section of the track and the moulds are moved into a position, prior to pouring, where they may stand until the metal is set, a practice to be recommended wherever roller track is used.

KEIGHLEY ASSOCIATION OF ENGINEERS held their fiftieth anniversary dinner on March 11. The guests included the Mayor of Keighley (Mr. G. S. Mason) and Major-Gen. K. C. Appleyard.

An Australian Engineer Surveys the Foundry Industry

A private letter from one of our Australian friends contains much that is applicable to this country. As it would suffer from sub-editing we reproduce the germane portion without alteration.

I think that Mr. G. would agree with me when I express my opinion that the moulding trade here is on a fairly ancient basis in a lot of places and that a lot of the bosses and their foremen could better themselves by knocking off for a bit and having a jolly good trip over to see you and get introductions the same as you gave to me to see how things are done, and I am pretty sure that this particular trade has always taken for granted that they get along with a minimum of machinery and that anything they should have to buy would be supplied to them for just about cost or under. My own particular line of machining component parts is somewhat different and more competitive and we think little of paying a couple of thousand for a lathe which would cost about half the price in England, and once we get it we have to fight like animals to get the agents to supply us with equipment, and then talk like lawyers to get our men to use fast speeds and feeds and tools which the machines are capable of and usually finish up by setting the darned things up ourselves and demonstrating.

There are several jobs for anyone outside the Big House and the Giggle House out here and we are willing to employ semi-hospitalised coves and look the other way if somebody works in his farm for a couple of days a week if he's good at his work, and if he's a "D.P." from Europe and cannot speak English we are prepared to make signs to him, and with an application to the Arbitration Court for a minimum basic wage of £10 per week of the present 40 hours I suppose it is all indicative of "business is good." Young Mr. O., of B., incidentally, is talking about coming out here and I hope he takes root in Sydney, as we all badly need a permanent gravity moulder here who can pour light alloys in dies without pressure, and I was very impressed with how easily he did it. I have the plant here that could start up a man such as he, but I haven't the time or the men to make this diversion, and I guess I shall just have to take the same castings in iron and keep on motoring round the various foundries scattered over 30 miles that supply me with batches not really big enough to feed my auto lathes and millers, and keep on encouraging them to keep my plates on the machines and somebody else's hanging on the wall. Johnny-on-the-spot gets the castings in this country and I am very much afraid our industrial religion is "dog eat dog"—fortunately there is, and always has been, plenty of gas for motoring, and whilst the roads are pretty bad on your standards we use a V.8 and push the pedal down and keep an eye in the rear vision mirror for cops, and one way and another we scrape through with enough tonnage to keep the doors open. Steel position is pretty bad, but the solution is to order 18 months ahead and keep a hundred ton or so we do not want and swap it against sizes we need, and cultivate the friendship of the coves that despatch from the mills and become very conversant with the rolling dates relative to sizes. This would sound odd, no doubt, but there is only one mill rolling rounds and hexes and only one bright finishing mill in N.S.W. Last hope is to use Nip or Belge steel as it costs double, and little U.K. mild steel is coming in at double local price.

Automotive Cast Iron, Including Brake Drums*

By R. A. McElwee

In presenting a Paper on the subject of automotive irons, the Author assumes that the interest lies largely in the normal specifications and the foundry practice as well as the routine tests conducted in automotive shops. It will simplify the presentation if the discussion be divided into those parts which require special treatment. On a basis of tonnage involved, the first group will be cylinder blocks and heads. While it is true that such specification-making bodies as the American Society for Testing Materials (A.S.T.M.) and the Society of Automotive Engineers (S.A.E.) have attempted to describe automotive irons, it is not always true that the manufacturer adheres strictly to those specifications. It should be mentioned that the committees of the two societies mentioned work in close harmony and their specifications are in general in complete agreement. It is noteworthy that the trend in all specifications is toward the acceptance of physical standards and that chemical composition is secondary. The tables which accompany the S.A.E specification (Tables I and II) are indicated as suggestions only and are not mandatory.

It should be of interest to this group that the suggested chemical composition presupposes some form of ladle addition which is known as inoculation. An explanation of how inoculation affects the specification is in order. The use of an inoculant is usually accompanied by an increase in tensile strength and deflection in transverse loading. However, another effect of the inoculant is the usual cause of its adoption in automotive practice. It has been found that it is possible to make an iron approximately 0.20 per cent. higher in carbon content and obtain by inoculation as good physical properties as were called for in the original specification. This higher-carbon level is appreciated by the foundrymen because of the tendency to lower shrinkage and improved general foundry characteristics of this metal. The above explanation has been given in order to account for the gradually developing tendency toward higher-carbon irons in most automotive specifications.

Higher Total Carbon

The S.A E. listing might be considered as indicating the trend in this direction. S.A.E. No. 120 suggests a carbon of 3.20 to 3.40 and a silicon of 1.90 and 2.20 per cent. The suggested composition calls for manganese from 0.60 to 0.90 per cent. In view of the fact that the sulphur is mentioned as being 0.12 per cent., it would appear that the manganese specification is on the high side. In the event that manganese should be placed on the list of strategic materials, this specification may assume a very important place in future discussions. The other element mentioned, phosphorus, is suggested at 0.15 per cent. There will be some metallurgists who will question the necessity for this low maximum. It is quite generally conceded that phosphorus in automotive irons is very closely related to shrinkage and the 0.15 per cent. in the specification represents the opinion of those who have had difficulties, which had been cured by consistently controlling this element. There are those who will insist that a limit of 0.20 or even 0.25 per cent. gives a safe working margin.

Referring again to the matter of higher total carbons, it should be emphasised that shrinkage is inversely related to total-carbon content and that many cases of trouble reported as "open iron" may be actually a condition of micro-shrinkage or microporosity. This is particularly noticeable in castings of intricate design and especially so when the iron is relatively low in total carbon and high in phosphorus.

Even if it were not possible to attain as high tensile values with the higher total carbon, there is still a justification for the higher-carbon practice from a standpoint of better co-relationship of casting and test-bar properties.

Few engineers would quibble over the acceptance of a 15 tons per sq. in. iron of known and proved soundness as being preferable to an 18-ton iron of higher shrinkage and consequently greater tendency to exhibit "open" areas at junctions of light and heavy sections. The experience of several large companies who have moved in this direction, lends weight to this viewpoint. No mention will be made of the effect of alloys, since it is the function of the alloy companies to exploit their own productions, and information is available as to the effect of each of the commonly-used elements which are classified as grey-iron alloys.

Physical Properties

Turning now to the physical-property specifications, it should be noted that S.A.E. No. 120, which is a cylinder-block iron, specifies a B.H.N. of 187 to 241. In the footnote it will be noted that this is taken on a bar of 1.2 in. dia., and that stress relieving at 565 deg. C. is permissible. The transverse load is given as 2,400 lb. and the deflection is 0.24 in. The tensile load is 15 tons per sq. in. Quite frequently, manufacturers have had difficulty in meeting both the transverse and tensile specifications. It might be assumed from the table that a certain factor exists which would indicate one from the other, but it has been found that the method of melting and foundry moulding practice may change this factor as much as 20 per cent.

Because it is not practical to obtain a chemical analysis at intervals of less than one hour in conventional shops and half an hour in shops equipped with spectroscopic analysis procedure, some method has had to be devised to serve as a routine check on each ladle. The chill test which is being developed as a standard by the American Foundrymen's Society is very generally used. It is conducted by pouring a sample of iron into a dry sand mould of such size as to cause the iron to show a white fracture over a part of the test casting. The depth or the width of this white

* A Paper presented at the Western Regional meeting of the American Society for Testing Materials. The Author is on the staff of the Vanadium Corporation of America.

Automotive Cast Iron

part of the fracture is recorded as indicating the suitability of the iron for the casting in question. The establishment of chill depth or width is a purely arbitrary standard which must be set up by each manufacturer depending upon his views on the permissible deviation from ideal structures and his desire to obtain maximum machinability.

Metallographic Specification

At least one manufacturer of diesel-engine equipment has adopted what is, in effect, a metallographic specification. It is quite generally agreed that this is the ideal situation. Unquestionably it would be adopted quite widely except for the difficulty of finding sources properly equipped to accept a metallographic description as a standard. This specification says, in effect, that the permissible deviation from pearlite or martensite shall contain not more than 5 per cent. of constituents such as ferrite or carbide. This arrangement is recognised by one or more of the machine-tool builders and seems to operate very well. It is quite probable that more microscopic specifications will be adopted as conditions permit.

Most automotive shops make, in addition to the cylinder iron described, what they refer to as a soft iron. This would be approximately equal to S.A.E. No. 110. The B.H.N. of this iron is established at 187 maximum and the strength at 9 tons per sq. in. This is used for all of those parts which are not subject to wear or excessive loads. A major development is in progress on this type of material. Costs of machining have been studied carefully, and the ability of carbide tools to stand up under terrific loads has made it possible to use speeds and feeds much greater than has ever been known before in machine-shop practice. An attempt is being made to obtain hardness low enough to permit these previously-unheard-of speeds and feeds. Two methods are being used. In one case, the castings are completely annealed; in the other, additions are made to the ladle which have the effect of softening the castings to meet these unusual requirements. The choice of the method is based on economic conditions.

Brake Drums

In the matter of brake drums, a completely different approach has been used. A large amount of research work has established the fact that a brake-drum material should have a minimum total carbon of 3.40 per cent. In fact, this value was itself a compromise, the general feeling being that 3.60 per cent. would have been better. Naturally, the silicon must be adjusted downward to obtain the desired hardness and strength. Two unusual things occur as a result of this practice. One is that the accepted standards of hardness must be revised. The larger amount of graphite makes the indentation of the ball much larger than the matrix would seem to justify. The other effect is that as the graphite content increases, the modulus of elasticity becomes lower. This is extremely important because of its relationship to the resistance of the iron to heat-checking. Alloys have not been specified in the official releases, but the writer's experience has been that the control of this type of structure is best handled with additions of molybdenum and vanadium. The resistance to heat-checking of high-carbon irons containing these two elements has been proved in glass moulds, reeler plugs and many other applications.

It is the Author's opinion that the trend in all automotive irons will be toward higher carbons, as foundrymen and engineers realise that a sound casting of 15 tons tensile is of greater value than a test-bar of 20 tons per sq. in., if the composition of the latter bar does not permit the making of sound castings.

TABLE I.—*American S.A.E. Specifications and Applications for Automotive-type Cast Iron.*

S.A.E. spec. No.	B.H.N.	Transverse (minimum breaking load in lb.)	Deflection (minimum in in.)	Tensile (minimum in tons per sq in.)
110	187 max.	1,800	0.15	8.9
111	170 to 223	2,200	0.20	13.4
120	187 to 241	2,400	0.24	15.6
121	202 to 255	2,600	0.27	17.8
122	217 to 269	2,800	0.30	20.0

Properties determined from arbitration test-bar (1.2 in. diameter as-cast or stress relieved at 565 deg. C. max.)

APPLICATIONS

S.A.E. 110.—Miscellaneous soft-iron castings (as-cast or annealed) in which strength is not of primary consideration. Exhaust manifolds may be made of this grade of iron alloyed or unalloyed.

S.A.E. 111.—Small cylinder blocks, cylinder heads, air-cooled cylinders, pistons, clutch plates, oil-pump bodies, transmission cases, gear-boxes, clutch housings, light-weight brake-drums, etc.

S.A.E. 120.—Automobile cylinder blocks, cylinder heads, flywheels, truck brake-drums, cylinder sleeves, cylinder liners, pistons, etc.

S.A.E. 121.—Truck and tractor cylinder blocks and heads, heavy flywheels, tractor transmission cases, differential-carrier castings, heavy gear-boxes.

S.A.E. 122.—Diesel-engine castings, liners, cylinders, pistons and heavy parts in general.

TABLE II.—*American S.A.E. Specifications of Chemical, Physical and Structural Requirements of Automotive Grey-iron Castings for Brake Drums and Clutch Plates.*

	Spec. S.A.E. 113, per cent.	Spec. S.A.E. 114, per cent.
Chemical Composition:		
Carbon, total ..	3.40 min.	3.40 min. (mandatory)
Silicon	1.10 to 1.70	1.10 to 1.70 (as desired)
Manganese	0.60 to 0.90	0.60 to 0.90 (as desired)
Phosphorus	0.20	0.20 (typical)
Sulphur	0.14	0.14 (typical)
Alloys	as required	as required
Physical Properties:		
Brinell	179 to 229	207 to 269
Transverse (minimum breaking load in lb.)	2,200	2,600
Deflection (minimum, in in.)	0.20	0.27
Tensile (minimum, in tons per sq. in.) ..	13.4	17.8
Structural Properties:		
Graphite	Type A, Size 2 to 4	Type A, Size 3 to 5
Matrix	Lamellar pearlite with ferrite if present not to exceed 15 per cent. approximately	Fine lamellar pearlite with excess constituent, free cementite or free ferrite or both not to exceed 5 per cent approximately

APPLICATIONS

S.A.E. 113.—Brake drums and clutch plates for moderate service requirements where high-carbon iron is desired and heat checking is a problem.

S.A.E. 114.—Heavy-duty drums and clutch plates where both heat checking and strength are definite requirements. Since the same base iron is indicated for both S.A.E. 113 and S.A.E. 114, it is presumed that alloys will be used especially in the latter to meet the strength and structural requirements.

Solidification of Steel Castings

In a well-documented Paper, resulting from much original research and which is printed in the February issue of the Journal of the Iron and Steel Institute, Dr. D. R. F. West, writing under the heading, "The Mechanisation of Solidification of Horizontal Steel Castings," has summarised his conclusions in the following statement:—

From the investigation of the solidification of carbon-steel blocks cast horizontally, the following conclusions may be listed:—

(1) The form of the crystal growth differed in the upper and lower halves of horizontal sand-cast blocks. The upper half consisted of columnar crystals, and the lower of nuclear crystals, for superheats below approximately 40 deg. C., and of equiaxial crystals for higher superheats. For the higher degrees of superheat there was a tendency for some columnar growth to occur from the lower surface (to the extent of ¼ to ½ in.).

(2) The form of the macrostructure did not depend upon whether the steel first solidified in the delta or in the gamma form.

(3) Placing chills on the upper or lower surfaces did not alter the fundamental difference in structure between the upper and lower halves, but the extent of the main crystal zones was altered by the action of the chills in moving the centre of freezing away from the geometrical centre.

(4) Temperature measurements in solidifying castings containing up to 0.8 per cent. of carbon showed that, although such steels may have a wide solidification range as indicated by the equilibrium diagram, yet, when solidifying in casting form, a large percentage of the steel solidified at an approximately constant temperature, which was taken as the liquidus for solidification under such conditions.

(5) When a sand casting of 3-in. square section was poured, the temperature fell to the liquidus throughout the section within a time which did not greatly exceed 1 min., even for the higher degrees of superheat (up to 120 deg. C.). By this time, the liquidus arrest was complete to a depth of approximately 0.2 to 0.5 in. from the surface. After this, solidification proceeded with no measurable temperature gradient in the liquid interior of the casting, the gradient between the sand/metal interface and the liquid/solid interface being the one of prime importance in regard to the rate of solidification.

(6) When the depth at which the arrest was complete was plotted against the square root of the time, the points lay on two straight lines, representing the solidification from the upper surface and lower surface respectively. These lines corresponded to the results of pour-out experiments on castings with the same degree of superheat, and led to the conclusion that they represented a stage in solidification when a close network of dendritic axes and branches, enclosing a relatively small amount of inter-dendritic liquid, had formed.

(7) The centre of freezing was approximately 0.1 in. above the geometrical centre, indicating that a greater amount of solidification had taken place from the lower surface. This agreed with the fact that the arrest began and ended earlier in the lower half of the casting.

(8) In both sand and chill castings, as a general rule, the centre of freezing corresponded to the junction of the upper and lower crystal zones, and only very occasionally was there a departure from this rule.

(9) Extrapolation of the solidification lines indicated an initial lag in the completion of solidification at the surface. The main effect of increasing superheat was to increase this initial lag, without greatly altering the slope of the solidification lines.

(10) Thermal differences set up when a casting was poured, explained why a greater amount of heat was extracted through the lower sand face as compared with the upper, and why the arrest began and ended earlier in the lower half of the casting.

(11) With chills 1 in. thick against the upper face of castings of 3-in. thickness, variation in superheat had little effect of the time of solidification; and there was no difference between the chilling powers of copper and steel. The chill thickness could be decreased to approximately ¼ in. without greatly reducing the chilling power.

(12) The main factor influencing the macrostructures of the castings, both sand and chill cast, was the distribution of centres of crystallisation during solidification, and its relation to the rate of solidification. The distribution of these centres was determined partly by the temperature conditions, and, more particularly, in horizontal castings by another effect, considered to be that of the gravity settling of crystallites, because their density exceeded that of the liquid by reason of the solidification contraction.

Indian Research Laboratories Opened

The establishment of 11 national laboratories is planned by the Council of Scientific and Industrial Research of India. Of these, the National Chemical Laboratory is nearing completion and was officially opened earlier this year by the Prime Minister of India, Pandit Nehru. The building is set in a natural amphitheatre of hills near Poona. Research is to be carried out in both pure and applied chemistry, and there will be nine departments:—Organic chemistry, bio-chemistry, chemical engineering, plastics and high polymers, survey and information, inorganic chemistry, physical chemistry, administration and standardisation of chemicals, development of bhilawan and cashew products.

The problem of selecting staff is gradually being solved by the director, Prof. J. W. McBain, who arrived in October, 1949, and has done much to promote the development of the Laboratory. Speaking of the importance of personal talent in research, Pandit Nehru expressed surprise at the lack of appreciation of science by industrial leaders. He added that the Indian Government had, during the past two years, at least laid the foundations of future scientific research.

National Physical Laboratory of India

In January, the Deputy Prime Minister, Sardar Vallabhbhai Patel, at New Delhi, opened the National Physical Laboratory of India, second in the chain of 11 national scientific institutions. Among those representing foreign science and research were Sir Robert Robinson, President of the Royal Society, Dr. E. U. Condon, director of the U.S. National Bureau of Standards, and Prof. P. Auger, head of the Department of Natural Sciences of UNESCO.

The laboratory, one of the largest of its kind in Asia, is to be India's custodian of standards of mass and length, and to assist in the full utilisation of the country's raw materials as well as in the improvement and standardisation of industrial methods and processes. It will have the first electron microscope to be set up in India, and will carry out research on radar, meteorology, the planetary system and cosmic rays.

There will be 10 divisions, *viz.*, weights and measures; applied mechanics and materials; heat and power; optics; electricity; electronics and sound; building and housing research; hydraulic research, also analytical chemistry and industrial research. A well-equipped workshop will manufacture equipment needed for the laboratory and other scientific institutions. Dr. K. S. Krishnan, F.R.S., has been appointed as the director of the new laboratory.

Leaders of the Industry

R. C. Shepherd

Mr. R. C. Shepherd, M.I.B.F., who was responsible for the layout and equipping of the new Beevor foundry at Lincoln, which is described in this issue, is general foundries manager of Ruston & Hornsby, Limited, Lincoln and Grantham.

Amongst other distinctions, he is a council member of the British Cast Iron Research Association and a member of its research board and other committees. He has been a member of the Institute of British Foundrymen since 1936 and was elected a member of Council in 1947. In addition, he has recently been appointed chairman of the I.B.F. sub-committee T.S./24 and is a past president of the Lincoln Section. Last year he was selected by the I.B.F. Council to deliver the official exchange Paper to the French *Association* in Paris, the title being "Some Trends in British General-engineering Foundry Practice."

MR. R. C. SHEPHERD.

In 1946 he acted as team leader of the Ministry of Supply B.I.O.S. team which was commissioned to study German engineering grey-iron foundries. He is also a member of the council of the Lincoln Engineering Society.

He has studied foundry practice during extensive tours in America and on the Continent and has delivered Papers on various aspects of this subject to numerous I.B.F. branches and other technical societies during the past few years. He was awarded the I.B.F. British Foundry Medal for his Paper on "Influence of Production Flow in Iron Foundries," presented at the annual conference in 1947.

In his spare time Mr. Shepherd is an enthusiastic golfer and helped to organise the very successful I.B.F. annual golf competition held at Woodhall Spa, Lincs, last year.

Mobile Showroom for Lighting Fittings

In the last few years Crompton Parkinson, Limited, have been extending and re-designing their showrooms throughout the country to provide for demonstration of the comprehensive range of lighting fittings they have developed. To provide similar facilities in areas where it is not always convenient to visit a showroom, the organisation now possess a mobile showroom equipped with representative lighting fittings. The mobile showroom consists of a special van body on a 5-ton Austin long-wheelbase chassis with 25-in. Baico extension.

British Bronze and Brass Ingot Manufacturers' Association

Mr. Alfred Allcock, the president of the British Bronze and Brass Ingot Manufacturers' Association, in the course of his report to the members at the annual general meeting held last week in Birmingham, said that during the year the council had met four times and three general meetings had been held. Two new members, John Allan (Glenpark), Limited, and Leopold Lazarus, Limited, had joined the Association. The Association was now represented on the Non-Ferrous Metals Standards Committee of the British Standards Institution; this would ensure that the Association was listed amongst the co-operating organisations set out in specifications issued by the B.S.I. relating to non-ferrous metals.

Research Associations

The president recalled that it was proposed to constitute a research group of those members willing to contribute on an agreed basis to the British Non-ferrous Metals Research Association, with the qualification that the contribution should be subject to a maximum of £50 per annum for any one member, and regretted that the Research Association had not accepted this qualification. Thus the matter was now in abeyance.

Ministry of Supply

Relations with the Ministry of Supply were excellent. He formed one of a deputation from the council to the Ministry to discuss export prices in June last, since when the Association's proposals on export prices had been accepted, including modifications in the system of granting licences. Regarding the toll conversion of residues, the Association was informed that this would only be authorised in cases where the imported material came from a hard-currency area.

In another important respect, that of the disposal of Ministry stocks of scrap, the Association had, by virtue of its being an organised body, been consulted, and was able to express its views on this matter.

Cost of Production

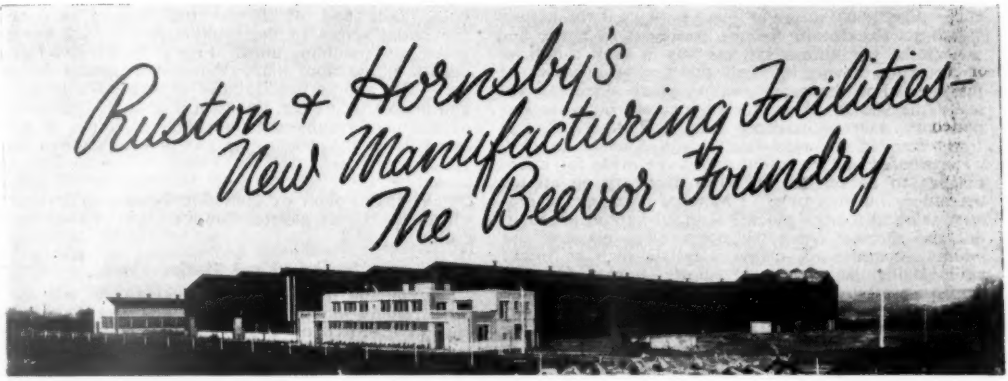
The council had recently circulated to all members tabulated information, kindly provided by eight members, on production costs of brass and gun-metal ingots. The council felt that this had been most informative and very well worth while; it was hoped that members had found the information of value as providing in some measure a yardstick with which they could compare their own costs.

Technical Committee

The technical committee, constituted in July last, was progressing quietly with its work, and would in due time produce worthwhile proposals. A separate report was presented, and he considered the appointment of this committee to be a significant and valuable development. Their efforts and the services which were being placed at the disposal of industry were worthy of wide publicity to bring them to the notice of the users of their products.

THE EXHIBITION OF INDUSTRIAL POWER, to be held at Kelvin Hall, Glasgow, in connection with the 1951 Festival of Britain, is being designed to display outstanding British achievements in heavy engineering and its associated technologies. The subjects covered will be mining, iron and steel, machine tools, power units, the generation and transmission of electric power, railways and shipbuilding. There will also be a section on the source of power of the future—nuclear energy.

Ruston & Hornsby's New Manufacturing Facilities—The Beevor Foundry



The new Beevor iron foundry of Ruston & Hornsby, Limited, Lincoln, officially opened early this year by Field-Marshal Sir William J. Slim, C.I.G.S., provides what is probably an unparalleled example of all that is best in post-war foundry construction. As the first part of the company's major rehabilitation scheme, it caters for an additional 250 tons per week of miscellaneous engineering castings up to 15 cwts. All operations are mechanised and the sections are fully integrated. Elaborate attention has been paid to flow production, job break-down, and provision of good working conditions.

Early Preparations

WHEN Mr. R. C. Shepherd, general foundries manager of Ruston & Hornsby. Limited, of Lincoln and elsewhere, presented a Paper at the 1947 conference of the Institute of British Foundrymen on the subject of production flow in iron foundries and its effect on efficiency per man-hour,* it was recognised as a masterly achievement and gained for its Author the Institute's British Foundry Medal. It was not so well realised at the time, however, that the exhaustive survey reported in the Paper of the pros and cons of flow production and job break-down was only part of the prelude to a major scheme for the building of new foundries which had long been envisaged by his company. The first part of the scheme has now come into fruition in the Beevor foundry (built adjacent to the main works at Lincoln), an exterior view of which is shown on this page.

The major raw material of the Ruston & Hornsby group of Diesel engine, locomotive and excavation engineers has always been iron castings, and their provision from their own foundries in quantity and quality to suit varied production requirements has been developed through the years on an ever-increasing scale. For some time before 1945, it had become obvious that expansion and re-organisation of the existing foundry capacity were necessary and plans were laid for a comprehensive scheme. Three foundries were envisaged, ultimately to confine the whole of the foundry activities to one site. The first of these foundries, for 250 tons per week of castings up to 15 cwts., is that which has now come into production as the Beevor foundry.

Study of foundry progress at home and abroad in several fields—equipment, flow-production methods, plant mechanisation, job analysis and technical control—was carried out on a broad basis and the epitome of best practice was embodied in the master plan. At this time, also, the report of the Joint Advisory Committee on conditions in ironfoundries (Garrett Report) was published. This stressed measures to be taken in foundries for improving working conditions. All the germane recommendations were adopted or improved upon in designing the new foundry.

Main Constructional Features

On a virgin site, about ¼ mile north-west from the main works at Lincoln, and now approached by an 18 ft. concreted road, building of the new foundry commenced in January, 1947. The unprecedented flooding during the Spring of the year caused an early set-back, however, conditions at that period being shown in Fig. 1. Special arrangements had to be made for de-watering the site (normal water level is only 5 ft. 6in. below ground), and then building continued without major interruption. Generally speaking, the shell was completed in 1948, equipment being installed in 1949. The total floor area of the building is 109,000 sq. ft.; there are five parallel bays, at right angles to the approach road, each 50 ft. wide, three 350 ft. long and two 325 ft. In addition, two bays, 60 ft. wide, at right angles to the others and on the further side from the approach road, house the raw materials, melting equipment, etc.; these are served each by a rail siding running inside the building. All floors are concreted and all operations, even those in the stockyard, are under cover. A separate brick-built two-storey amenities block adjoins the foundry proper and fronts on to the approach road; this is self contained and covers over 9,000 sq. ft. The general constructional materials for the foundry were somewhat limited by post-war building conditions, but by installing individual panes to the extent of one-third the

* I.B.F. Proc., Vol. XL. Paper 883. A169.

The illustration at the head of this page is an external view of Beevor Foundry, with the Amenities Block in the foreground.

Beevor Foundry

floor area, 3,000 sheets of glass were used for natural lighting. Excavation for the basement to house and service the sand-return systems was in itself a difficult undertaking, having in mind the low-lying nature of the site. For the sand-handling plant alone, a total length of 900 ft. of reinforced-concrete pit work was necessary, varying in depth from 8 ft. to 17 ft. and from 7 to 15 ft. wide. All this had to be securely waterproofed and provision had to be made for maintenance to be carried out when necessary on all the machinery underground. Mercury-discharge lamps were selected for the general artificial lighting throughout the shops. When the project was planned and building commenced, many materials such as bricks and glazing bars were in short supply; for this reason, protected metal sheeting was used for the main construction.

Of the total floor area, the proportions allocated for the various sections are roughly as follow:—

	sq. ft.
Raw-material handling and cupolas ...	18,000
Green-sand moulding	29,000
Dry-sand moulding	16,000
Core making	15,000
Sand treatment	16,000
Fettling and despatch	15,000

As some of the sections are to a certain extent overlapping, as for example the sand plant and moulding, these figures must be considered only as very approximate.

Disposition of Plant

The general layout comprises four mechanised units for green-sand moulding, a dry-sand moulding section, a centralised sand-conditioning plant, melting plant, core shop, fettling shop and auxiliaries (power house, boiler house, etc.). The four green-sand moulding loops are disposed crosswise at the approach-road end of the three centre parallel bays. At the other end of the centre bays are the sand plant and the dry-sand moulding section, side by side. The two extreme-side bays are used for the core-shop and dressing shops respectively, while the crosswise bays at the further end from the approach road house raw-material sidings, stockyard, drying stoves, and melting plant.

Fig. 2 is an interior view which gives an impression of the lofty buildings (32 ft. to the eaves, 24 ft. to the crane rails and 43 ft. to the ridge), and shows the initial stages in the installation of plant for the green-sand moulding units. Figs. 9 and 10 give further details of the floor plan. Additional general features are:—The almost prodigal use of space for gangways and internal transport; the careful siting and integration of production units and individual machines so as to avoid waste movement; the grouping of sections on a functional basis, and the elaborate precautions for providing for fresh air and the removal of fumes. Details of this plant are quoted in the section devoted to amenities. Other general interior views are shown in Figs. 6, 7 and 8.

Stockyard and Melting Plant

The cupola raw-material stockyard is served by a rail siding and consists of a number of concrete bunkers arranged on either side of a sunken narrow-gauge track served by a scale car for the make-up of cupola charge in drop-bottom buckets. Fig. 3 shows this section, with the scale car in the foreground. A 15-ton Heywood overhead crane carrying a 10-ton capacity magnet and a 5-ton grab is used for unloading metal or coke and limestone respectively from the rail trucks into the bunkers. The drop-bottom buckets containing 10-cwt. metal charges are hoisted from the scale car by a 2-ton capacity charging crane, the jib of which inserts them into the charging aperture of the cupola in use. The release of the contents is effected by a "wishbone" device which supports the top of the bucket on the furnace shaft while the bottom is lowered by the crane (Fig. 4).

The "Constructional" cupolas, of which four are provided in order to operate two daily, are equipped with Foxboro-Yoxall blast-volume equipment and are blown by 4,000 cub. ft. per min. Keith-Blackman fans. Each is of nominal 6 to 7 tons per hr. capacity at 3 ft. 6 in. internal diameter and has a spark arrester fitted. The charges generally incorporate about 15 per cent. steel scrap and late addition of ferro-silicon or other alloys and wedge control testing is practised at the spout. Slag and over-metal disposal is at present arranged in a somewhat primitive fashion due to the lack of equipment.

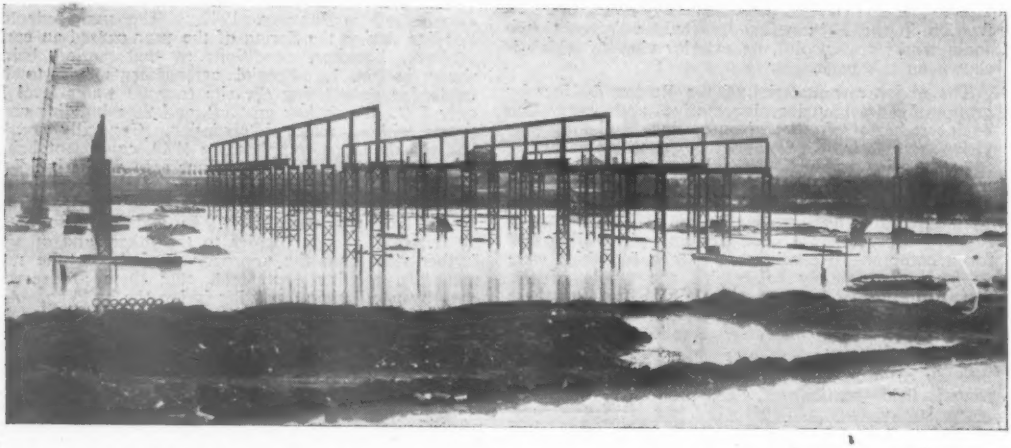


FIG. 1.—EARLY STAGES DURING THE CONSTRUCTION OF BEEVOR FOUNDRY IN SPRING, 1947, WHEN WORK WAS HELD UP BY FLOODING. ARRANGEMENTS HAD TO BE MADE FOR CONTINUOUS DE-WATERING OF THE SITE.

Metal is tapped into drum-type ladles of which several sizes are available, from 10 cwt. upwards. These are carried, initially, from an overhead, motorised, 2-ton capacity pulley-block, and after being filled are lowered on to electric platform trucks for transport to the pouring stations. For pouring the moulds, metal is distributed in Roper one-man-operated covered ladles serving the mould conveyors and carried from monorails.

Green-sand Moulding Units

The four mechanised units for green-sand moulding are all equipped with British Moulding Machine Company, Limited, plant, and cater for various ranges of castings as follow:—

Unit No. 1 is for snap-flask moulds and employs four pin-lift machines to take boxes in the 16 by 16 by 8-in. range producing 40 to 60 boxes per hr.

Unit No. 2 also uses pin-lift machines; box sizes are 30 by 21 by 4 in. or 16 by 16 by 8 in., and the machine output is similar to Unit No. 1.

Units 3 *and* 4; both have two A.T.3 turn-over machines and two R.D.5 machines taking boxes from 21 by 21 by 14 in., to 36 by 30 by 8 in. Output is from 40 to 50 moulds per hr.

Each unit consists of a continuously moving plate conveyor arranged as a loop and running at a speed which is variable between 3 and 12 ft. per min. Plate sizes are 5 ft. by 2 ft. 6 in.; units three and four have 49 plates and, one and two, 33 and 46 plates respectively. The cooling side of each loop is covered by a sheet-metal hood from which fumes are exhausted. A close-up view of pouring is shown in Fig. 5 and the green-sand units are shown, generally, in Figs. 6 and 13 (from the pouring-station end).

Arrangements for Differing Sizes

Although the green-sand units are generally similar in layout, they differ in detail, as will already have been realised from the machine sizes quoted. For example, of the four moulding machines serving No. 2 unit (Fig. 11), two are of the plain pin-lift type (inside the loop) and the others are pin-lift jolt-squeeze machines. The bottom half-moulds are made on the machine closest to the pallet conveyor and are placed directly upon it. The outside machines make top halves, which are fed along roller conveyors to the pallet conveyor to allow time for coring up before closing. Weighting and fitting of runner cups is effected before the bottom of the loop (the pouring station) is reached. At the opposite end of the loop—not far from the machines—is the pneumatic push-off and knock-out grid.

On the Nos. 3 and 4 units, the arrangements are somewhat different (Fig. 12). The bottom half-moulds are made, as before, on the machines adjacent to the pallet conveyor but, instead of being transferred directly to it, these larger moulds are rolled off the machines on to a roller conveyor before being mechanically hoisted for transfer to the pallets. The top part-moulds are similarly treated; thence follows a similar sequence to that for the smaller moulds except that the push-off and knock-out is adapted differently for the heavier jobs. Figs. 14 and 15 are close-up views of two of the larger machines in the original and rolled-over positions; of particular interest is the automatic arrangement for bringing into operation the short rollers for taking the weight of the mould and thus obviating any manual effort.

Knocking Out

Figs. 16, 17 and 18 provide sequence illustrations of the knocking-out operation for the heavier moulds. When the pusher discharges the mould on to the vibrating grid, three fork arms lift the mould to near vertical, after which it requires little manual effort to disperse its contents. Hot castings are placed in the brazier-type stillages shown in Fig. 19, for transport on roller conveyors to the fettling shop. Moulding boxes are returned to the machines on the pallet conveyor. Each knock-out station is fitted with effective dust, steam and fume extraction systems.

Dry-sand Moulding

The dry-sand moulding unit comprises a gravity-roller system having its own sand plant—or, rather, two sand plants, one for facing and the other for backing sand. Mould sizes vary from 26 by 26 by 10 in. to 54 by 40 by 36 in. Pattern plates are fed continuously into the system and at each operating point there are appropriate handling devices. Briefly, the sequence is:—(*a*) Adding facing sand to the pattern, tucking and

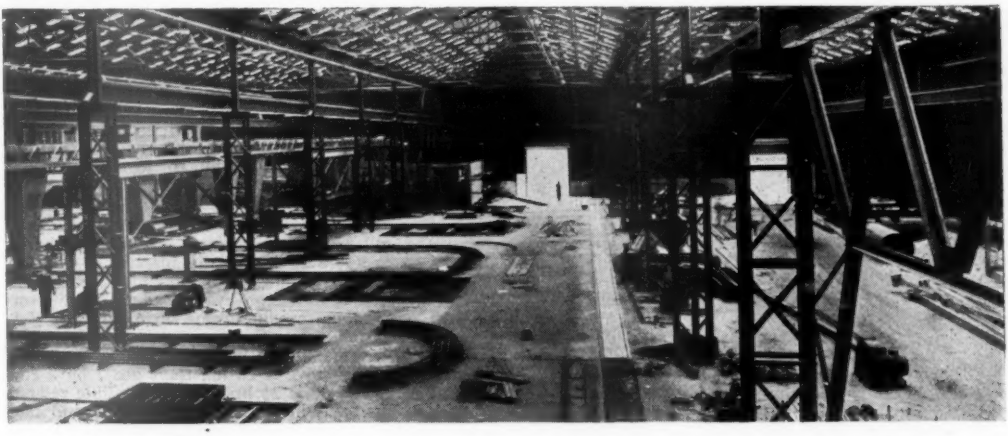


FIG. 2.—GENERAL VIEW OF THE INTERIOR OF THE FOUNDRY BUILDING DURING THE INSTALLATION OF PLANT. PARTICULARLY NOTEWORTHY ARE THE LOFTY CONSTRUCTION AND THE NATURAL ROOF LIGHTING.

FIG. 3.—CUPOLA RAW MATERIAL BUNKERS AND CHARGE MAKE-UP. THE SUNKEN RAIL TRACK AND SCALE CAR ARE IN THE FOREGROUND.

FIG. 4.—CHARGING A CUPOLA FURNACE FROM A DROP-BOTTOM BUCKET CARRIED BY A SNOUT CRANE.

liftering; (*b*) placing the moulding box; (*c*) ramming the backing sand from a Sandslinger; (*d*) stripping, for which two large Pneulec " Herman " roll-over machines (4,000 lb. and 1,500 lb. respectively) are provided; (*e*) mould finishing and drying overnight in coke-fired, bogie-type stoves—four, 20 by 10 by 8 ft., made by Foundry Refractories, Limited, and incorporating recirculatory systems for hot-air, have been built; (*f*) closing and casting; (*g*) knocking-out on a large mechanical vibrating grid. The grades of labour are selected each to perform only a few specified operations so that a minimum amount of skill is required by each.

Core Making

A general view of the core shop is shown in Fig. 7. Core sand is obtained from a batch-type 10-cwt.-capacity " Rotoil " mixer and supplied in stillages to the individual core-makers' benches. The latter are situate at right angles to the " green " core conveyors—

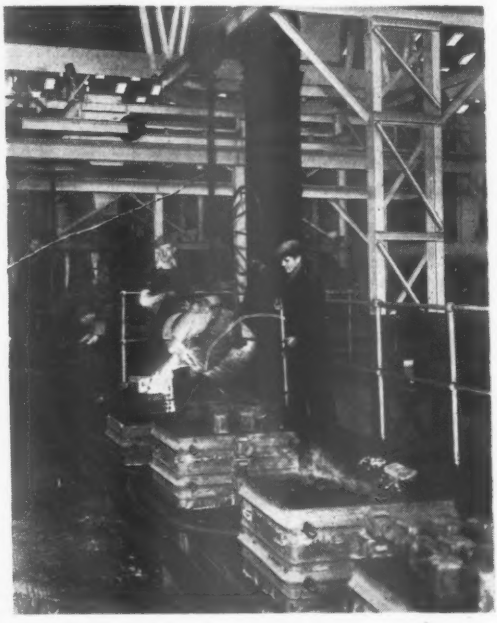


FIG. 5.—POURING OF MOULDS CARRIED ON A PALLET CONVEYOR. ONE-MAN-OPERATED, COVERED LADLES, SUPPORTED FROM AN OVERHEAD RUNWAY, ARE USED.

one a steel-band conveyor for the smaller cores and the other a roller conveyor for large jobs. In the large core conveyor there is a specially-adapted core turn-over machine to facilitate the handling and stripping of heavy cores. Both conveyors lead to a 5-loop vertical continuous gas-fired core-stove supplied by Foundry & Engineering Company (West Bromwich), Limited. The maximum height of core which is catered for in this stove is 28 in., trays are 7 by 2 ft., and the normal cycle is 2¼ hrs., with a possible reduction to 1¼ hrs. and increase to 4½ hrs. Beyond the stove, dried cores are finished and stored in racks preparatory to being delivered to the moulding stations. Normally, the core-making programme is one week ahead of moulding. The shop is staffed entirely by girls.

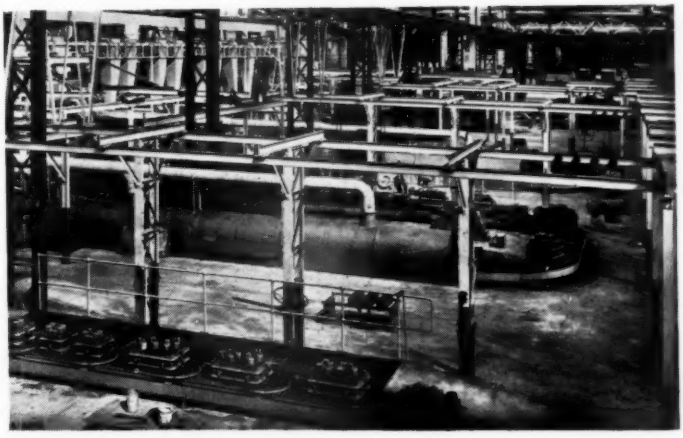


FIG. 6.—GENERAL VIEW OF THE GREEN-SAND MOULDING SECTIONS, TAKEN FROM THE POURING-STATION END OF NO. 4 UNIT. ON THE TOP LEFT-HAND SIDE IS A ROW OF SAND HOPPERS ABOVE THE MOULDING MACHINES AND IN THE CENTRE IS ONE OF THE FUME-EXTRACTION HOODS.

FIG. 7.—VIEW OF THE CORE-MAKING SECTION SHOWING THE TWO CONVEYORS WITH INDIVIDUAL BENCHES ALONGSIDE. IN THE BACKGROUND IS THE FIVE-LOOP CONTINUOUS STOVE. PANEL-HEATING UNITS CAN BE SEEN SUSPENDED FROM THE MAIN COLUMNS AND WARM- OR COLD-AIR DUCTS ARE VISIBLE ON THE RIGHT-HAND SIDE.

FIG. 8.—FETTLING SHOP, SHOWING THE USE OF GRAVITY ROLLER CONVEYORS FOR BOXES OF CASTINGS BEHIND THE GRINDING MACHINE OPERATORS. OTHER CONVEYORS SERVE THE SORTING, HAND-TOOL, AND INSPECTION BENCHES.

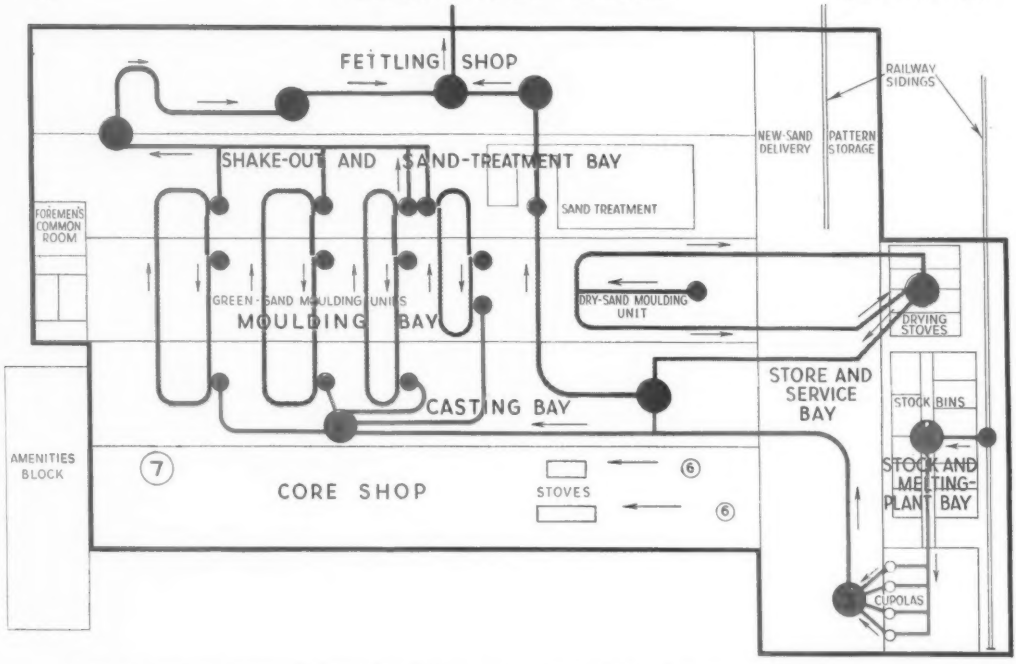


FIG. 9.—BEEVOR FOUNDRY FLOW DIAGRAM FOR MATERIALS AND WORK IN PROGRESS. ARROWS SHOW DIRECTION OF MOVEMENT, ALL OF WHICH IS MECHANISED.

Key to Numbered Sections

1. Rail delivery point for cupola raw materials.
2. Raw material storage bins and cupola-charge make-up.
3. Tapping molten iron into distributing ladles.
4. Transfer of molten iron to individual casting ladles.
5. Mould pouring stations.
6. Core-making stations.
7. Core finishing and distribution.
8. Moulding-machine stations for green-sand work.
9. Knock-out stations.
10. Area for dry-sand moulding.
11. Mould drying stoves.
12. Core setting, closing and casting area for dry-sand moulds.
13. Shake-out for dry-sand moulds.
14. Shot cleaning plant.
15. Fettling, grinding and finishing of light castings.
16. Fettling of heavy castings.
17. Despatch.

Production Flow

No foundry can be efficient if there are "bottlenecks" of materials used for manufacture and of work-in progress. Such bottlenecks are caused either by congested plant or by reversals of the flow-production pattern. That both these factors have been eliminated from the Beevor foundry is amply demonstrated by considering the flow diagrams shown in Fig. 9 for metal and work in progress and Fig. 10 for sand treatment and distribution. (Other illustrations, particularly Figs. 6, 7, 8 and 13, show how generous has been the provision of space.)

The layout makes use of self-contained groups of plant on a functional basis—for metal melting, moulding, core making, sand treatment and fettling. These are segregated into well-spaced and clearly-defined areas inter-connected by mechanical transport devices. Movement of operators has been reduced to a minimum and their individual jobs have been studied so as to reduce fatigue. Continuous operation has been arranged for repetition work (green-sand moulding, core-making and sand treatment) with sufficient flexibility to allow for pattern and core-box changes. Only the dry-sand moulding has been developed on the "bank" system. In that case it is necessitated by the requirements of overnight mould drying and the drying stoves provide the "bank." Variation in casting size and cooling time has been looked after by varying the length and speed of the four green-sand mould conveyors.

Materials and Moulds.—First, considering flow of metallic materials and starting at point (1), Fig. 9, the cupola raw materials are unloaded from rail trucks by overhead crane, grab or magnet and transferred to storage at (2). Cupola charges are made up into drop-bottom buckets carried on the scale car and hoisted and discharged into the furnaces, again by overhead crane. At (3), the molten iron is tapped into drum-type ladles; these are conveyed on electric trucks to (4), and (12), for transfer of metal into casting ladles.

Core-making begins at area (6), and finished cores are distributed from (7), to the various core-setting stations. Areas (8) are devoted to green-sand moulding and cores are set and moulds are closed between these and points (5), at which they are poured. From (5) the green-sand moulds are conveyed through cooling tunnels to the knock-out stations (9).

Dry-sand moulding begins at point (10), finished part-moulds are dried at (11), and conveyed to (12), for core-setting, closing and pouring; the shake-out for these moulds is at point (13), which lies over the used-sand return conveyor. Dry-sand moulded castings are fettled at area (16), and despatched from (17). Green-sand moulded castings are shot cleaned at (14), fettled at (15), and despatched also from area (17).

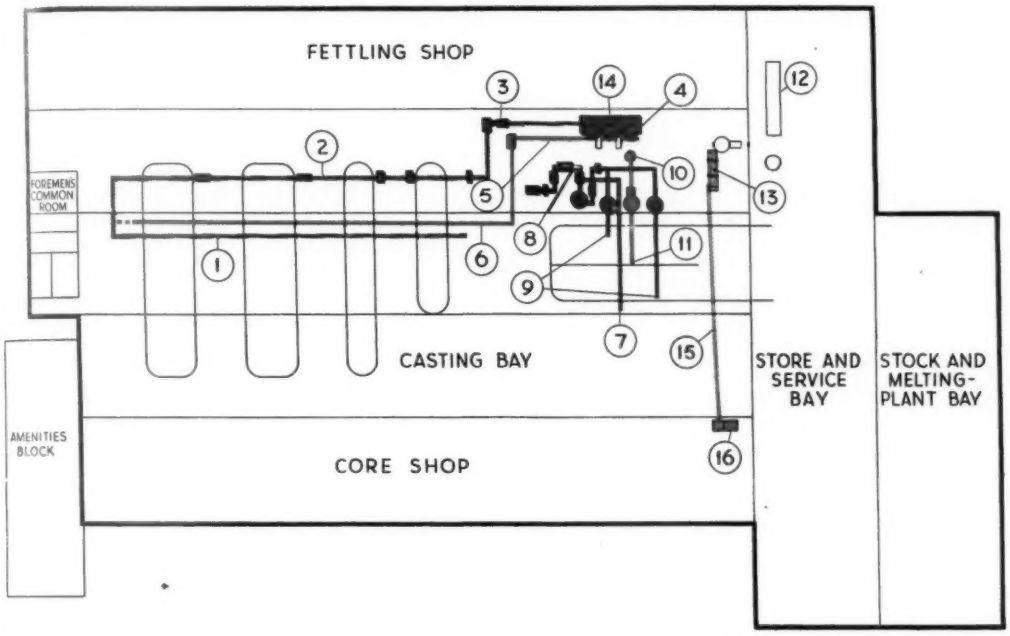


FIG. 10.—DIAGRAM SHOWING THE FLOW PATTERN FOR SAND TREATMENT AND DISTRIBUTION THROUGHOUT THE FOUNDRY.

Key to Numbered Sections

Green-sand Unit :
1. Spillage from the moulding machines.
2. Sand from the knock-out stations.
3. Rotary screen and permeability controller.
4. Simpson-type mixers.
5. Reconditioned sand.
6. Distribution of reconditioned sand to the machines.

Dry-sand Unit :
7. Spillage from Sandslingers.
8. Backing-sand reconditioning plant.
9. Backing-sand delivery.
10. Facing-sand mixing station.
11. Facing-sand delivery.

New Sand :
12. Apron conveyor.
13. Rotary drier for raw core-sand.
14. Mixing station hoppers.

Core Sand :
15. Pneumatic lift to core-shop.
16. Core-sand mixing station.

Sand Treatment and Distribution.—The flow diagram for sand treatment and distribution is shown in Fig. 10. The whole sand system of the foundry is based on "synthetic" sand using Chelford fine sand and North African bentonite for green-sand moulding. Congleton sand is used with proprietary binders for cores and with bentonite and cereals for dry-sand moulding. The system, which was mechanised by August's, Limited, may be considered as divided into four separate functional units:—(*a*) A green-sand unit, which, being designed to handle 50 tons per hr., is by far the largest and most elaborate; (*b*) a facing-sand unit for dry-sand moulding; (*c*) backing sand supply for dry-sand moulding (10 tons per hr.), and (*d*) core-shop supply.

Beginning with the green-sand moulding section, spillage from the moulding machines at (1), Fig. 10, and return sand from the knock-out stations (2) is taken underground on a common belt conveyor to the main sand plant situated at the far end of the same bay. Tramp metal is separated by an Overband magnetic separator before the sand is broken up in a disintegrator and elevated to a rotary screen (3), and permeability controller. From here the sand is discharged on to another belt conveyor which delivers it direct to three 40-ton capacity hoppers (14), over three Simpson-type batch sand mixers (4). New sand, from rail delivery sidings inside the building in the adjacent crosswise service bay, is unloaded on to an apron conveyor (12), and is carried to points over the mixers for controlled addition during the milling. Reconditioned sand (5) is discharged on to a slow-moving belt conveyor, from which it is elevated to an aerator which serves the main feeding belt (6) for distribution and plough off to the sixteen moulding-machine hoppers.

Next, considering dry-sand moulding, spillage from the Sandslingers (7), Fig. 10, and return sand from a "Sterling" shake-out is delivered to a separate reconditioning plant (8). New facing sand is taken from a mixer (10), adjacent to the main system, and delivered to point (11), for packing round the patterns on the dry-sand moulding gravity conveyors. Backing sand after being reconditioned at (8) is re-delivered to the Sandslingers at (9).

Finally, silica sand for core-making is dried at (13), in a rotary gas-fired drier for handling 3 to 4 tons per hr., and then is carried by suction lift-pipe (15) overhead to the core-sand mixing station hoppers, from where it is taken as required to the batch-type Fordath core-sand mixer (16). An advantage of the suction-lift system is that it also serves to cool the dried silica sand *en route*.

FIG. 11.—GROUP OF FOUR MOULDING MACHINES ON GREEN-SAND UNIT NO. 2. DRAG-HALF MOULDS ARE PLACED DIRECTLY ON THE PALLET CONVEYOR (CENTRE) AND COPE HALVES CONVERGE ON ROLLER CONVEYORS TO THE PALLETS FOR CLOSING, WEIGHTING AND FITTING OF RUNNER BUSHES. THE MOULDS THEN TRAVEL TO THE POURING STATION.

FIG. 12.—GROUP OF FOUR MOULDING MACHINES (REAR) ON GREEN-SAND UNIT NO. 3. TWO MACHINES HAVE CONVEYORISED SAND FEED FROM THE OVERHEAD HOPPERS. CORE PLACING IS EFFECTED ON THE ROLLER CONVEYORS SHOWN IN THE FOREGROUND AND CLOSING AND TRANSFER TO THE PALLETS IS DONE BY HOISTS CARRIED ON A TRANSVERSE OVERHEAD RUNWAY.

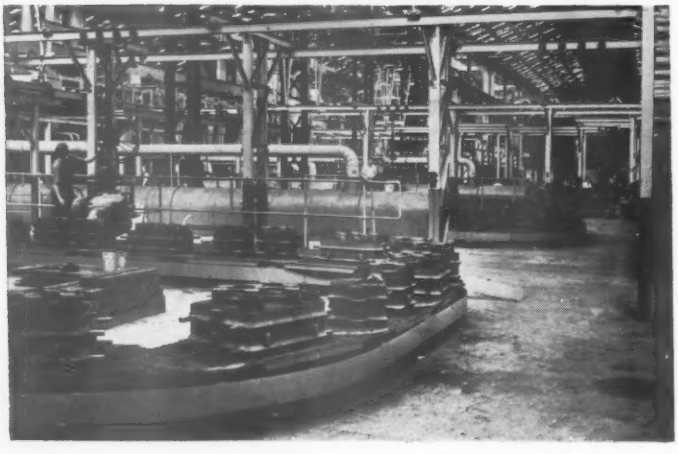


FIG. 13.—POURING STATIONS ON THE GREEN-SAND UNITS, SHOWING THE GENEROUS PROVISION OF SPACE FOR THE MOVEMENT OF METAL-DELIVERY BOGIES AND POURING LADLES.

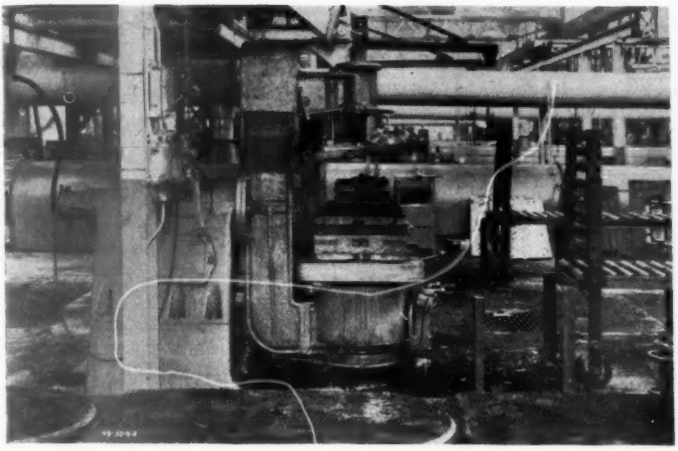
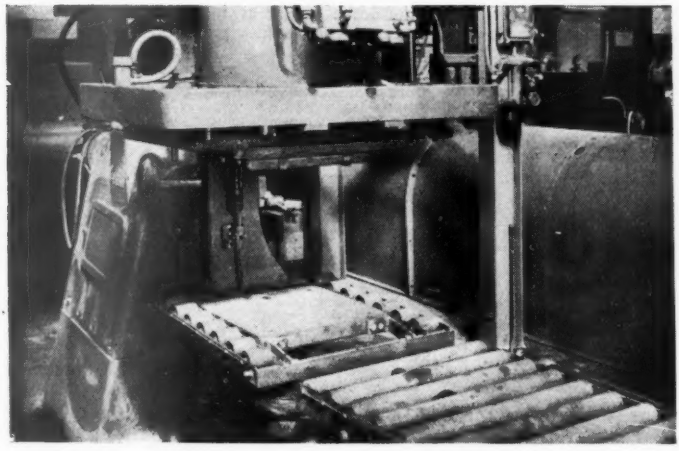


FIG. 14 (ABOVE).—ONE OF THE LARGER MOULDING MACHINES IN POSITION FOR MOULDING. NOTE THE COUNTERBALANCED SWING SECTIONS OF ROLLER TRACK WHICH ARE SUBSEQUENTLY LOWERED TO RECEIVE THE HALF MOULDS AS THEY LEAVE THE MACHINE.

FIG. 15 (BELOW).—CLOSE-UP OF ONE OF THE LARGER MACHINES AFTER ROLLING OVER AND MOULD DELIVERY, SHOWING THE TRIP MECHANISM FOR BRINGING THE SHORT SIDE ROLLS INTO COMMISSION. THIS AUTOMATIC MECHANISM IS A SPECIAL FEATURE INCORPORATED IN THESE MACHINES.



Fettling Shop, Inspection and Despatch

Fig. 19 illustrates the first of the fettling and grinding operations carried out in the dressing shop. The brazier-type baskets of castings are brought from the knock-outs on roller conveyors and are pushed off on to banks of rollers. Runners and risers are then separated and the castings are sent next for cleaning on a "Sand Wizard" machine comprising a 90-in. rotary table. Scrap is returned in stillages to the melting shop by electric elevating trucks. Castings are then sorted into sheet-steel-lined boxes for individual dressing, grinding, inspection, and finally for despatch to the company's machine shops situated in the main works. Fig. 8 shows a general view of the dressing shop.

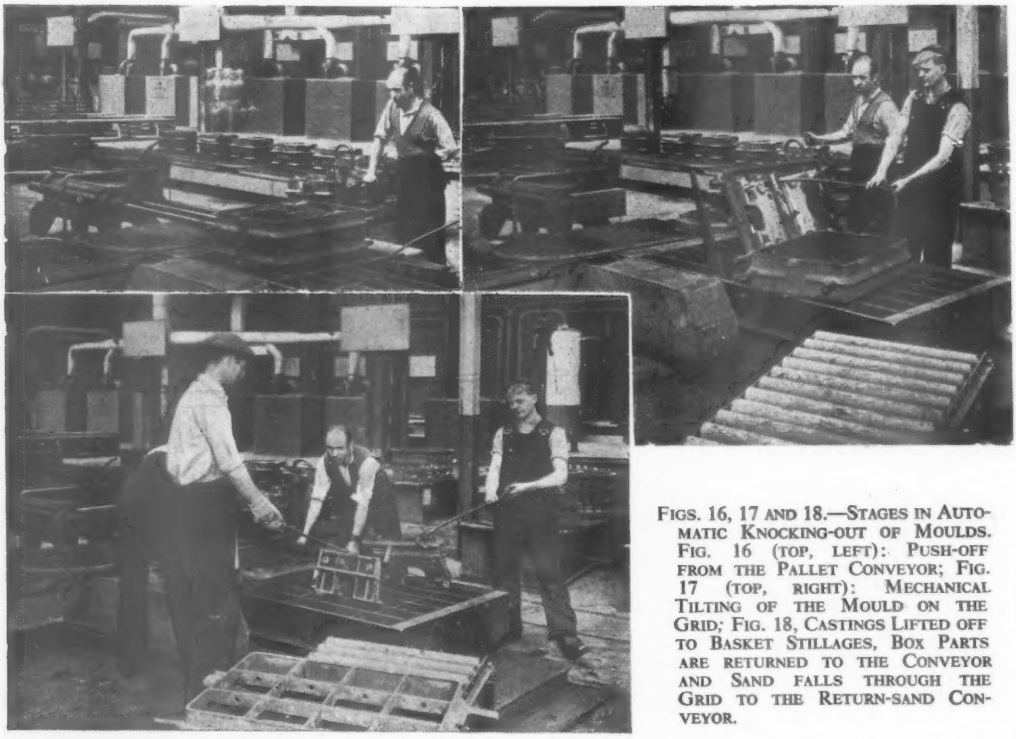
Amenities

A separate air-conditioned double-storey building, the exterior appearance of which is shown in Fig. 20, houses modern cloakrooms, washing and sanitary accommodation for both sexes. In addition there is a girls' rest room and canteen on the first floor, and a first-aid room.

Individual lockers for clothes are provided for men and women operators, each being supplied with cool or warm air so that no "staleness" develops even though the clothing be damp. In the men's locker room 300 are provided, but there is space for an additional 350. Showers, wash-basins and footbaths are available for all employees; the showers for the girls being neck-high so as not to wet their hair. All the lighting is of the fluorescent type, and the floors are either Flexicrete or Terrazzo. A separate block is used as a foremen's cloakroom, in this there is a common room for reading and discussions.

Heating and Ventilation.—In the foundry, generally, heating and ventilation arrangements are on a scale perhaps never surpassed. Radiant high-pressure hot-water panels (Fig. 7), 102 of which are suspended throughout the interior bays, provide for an inside temperature of 50 deg. F. (fettling 55 and core making 65) when outside "temperature is at freezing point. Supply for these "Crittall" units is from a Ruston "Thermax" 10,000,000 B.T.U. oil-fired boiler. In addition, warm-air inlets provide 119,500 cub. ft. per min. at 65 deg. F. (equivalent to 4/5 air changes per hr.), if required, and "hot-spot" extraction is arranged up to a total of 161,000 cub. ft. per min. An over-all picture of the extent to which dust extraction and fume removal plant has been installed can be gained from Table I.

One point of particular interest is the segregation of all knock-out stations and sand-treatment plant into one bay. This area has been generously equipped with fume-extraction plant, but, if at any time this should prove inadequate, the whole bay can be partitioned off



FIGS. 16, 17 AND 18.—STAGES IN AUTOMATIC KNOCKING-OUT OF MOULDS. FIG. 16 (TOP, LEFT): PUSH-OFF FROM THE PALLET CONVEYOR; FIG. 17 (TOP, RIGHT): MECHANICAL TILTING OF THE MOULD ON THE GRID; FIG. 18, CASTINGS LIFTED OFF TO BASKET STILLAGES, BOX PARTS ARE RETURNED TO THE CONVEYOR AND SAND FALLS THROUGH THE GRID TO THE RETURN-SAND CONVEYOR.

from the rest of the foundry without interrupting any flow-production pattern.

Colour.—A uniform colour scheme has been adopted throughout the shops and the amenities building. Up to 4 ft. 6 in. above the floor dark blue paint has been used and above this a Wedgwood blue. Exceptions are where standard colours have been used for plant and services such as cranes, switchgear, piping, etc.

Labour.—As was stated initially, the whole layout was based on job break-down to localise the appropriate degrees of skill just where, and only where, that skill was required. That object is well realised. Completely raw labour at the commencement has been so trained that, after but a few months' operation, output is well over 50 per cent. of that scheduled and quality is well to the fore; this has been achieved despite some handicaps due to lack of essential equipment yet to be installed. It is interesting to find the whole labour force organised on an incentive basis and to learn that no general mid-day break is allowed to interrupt production. Instead, the men take staggered 10 min. rest pauses and leave earlier at the end of the day as a consequence—a routine they much prefer.

CONTRACTORS AND SUPPLIERS OF PLANT FOR BEEVOR FOUNDRY.

Structural steel work	James Austin & Sons (Dewsbury) Limited
Main building contractors	Winton Construction Company Limited
Power and lighting installation	Edison Swan Electric Company Limited
Casting runaways	Geo. W. King & Company Limited.
Core conveyor	Steel Band Conveyor & Engineering Company Limited.
Core-drying stores	Foundry & Engineering Company (West Bromwich) Limited.
Core-sand mixer	Fordath Engineering Company Limited.
Cupolas	Constructional Engineering Company Limited.
Cupola-charging equipment and overhead cranes	S. H. Heywood & Company Limited.
Dry-sand moulding machines	Pneulec Limited.
Dust and fume removal plant (general)	Musgrave & Company Limited.
Dust extraction (fettling, etc.)	Spencer & Halstead Limited.
Electric trucks	Ransomes Sims & Jefferies Limited
Green-sand moulding and core-making machines	British Moulding Machine Company Limited
Grinding machines	F. E. Rowland & Company Limited.
Ladle and casting equipment	E. A. Roper & Company.
Mould-drying stoves	Foundry Refractories Limited.
Overhead cranes	Vaughan Crane Company Limited.
Railsidings	Thos. Summerson & Sons Limited.
Rotary sand drier and air-lift system	August's Limited.
Sandslingers	Foundry Plant & Machinery Limited.
Sand-treatment plant and mould conveyors	August's Limited.
Shop heating and ventilation	Richard Crittall & Company Limited.
Shot cleaning machines	Constructional Engineering Company Limited

TABLE I.—*Capacities of Dust-collection and Fume-removal Plant arranged for Individual Items and by Section.*

Individual items.	cub ft. per min.
Dust from Green-sand Unit Knock-outs	30,000
Dust from Dry-sand Unit Shake-out	25,000
Air from: Green-sand Unit Knock-outs	4,200
Belt Transfer Points ..	1,000
Permeability Controller	3,500
Sand Mills	1,560
Cooling Tunnels	8,000
Dry-sand Cooling Tower	15,000
Sand Drier	12,000
Sand Wizard	3,600

Section.	cub ft. per min.
Cupolas ..	8,000
Fettling Shop Plant ..	18,800
Green - sand Units ..	28,980
Cooling Tunnels ..	37,000

Horse Power.—Before leaving the general question of amenities and aids to production, it is illuminating to quote some figures for the horse-power available in relation to the size of the building (109,000 sq. ft., plus 9,000 sq. ft. for the amenities block) and the labour force of 270 to 300, all in. The total h.p. (excluding amenities) for workshop uses and mechanical aids is 1,162, or 3.87 h.p. per man (300 men). Direct amenities use 390 h.p. or 1.30 h.p. per man—a very high proportion of the total; this is not counting the heating by the Thermax and other boilers, roughly equivalent to 330 h.p., another 1.10 per man, or making a grand total of 6.27 h.p. over-all per man.

Conclusion

No apologies are thought necessary for describing this new plant with some wealth of detail. It is a foundry laid down from start to finish, if not with a disregard of capital expense, then at least with the idea of subjugating limitation of capital outlay to the primary requirements of higher productivity by provision of superlative mechanical aids, by job break-down to the lowest degree of skill necessary and by complete integration of the whole. Beevor foundry may long be regarded as a milestone in foundry progress—not only in this country—one for which only the best was good enough and from which only the " best " castings should be expected.

The Author records his thanks to the directors of Ruston & Hornsby, Limited, for permission to publish his account, and to Mr. R. C. Shepherd, Mr. A. Swain, and Mr. S. S. Seabrook for the facilities accorded him at Beevor foundry and the help so freely given in preparing the article.

FIG. 19. — FIRST OPERATION IN FETTLING—REMOVAL OF RUNNERS AND RISERS. BASKET STILLAGES ARE CARRIED ON SHORT ROLLER CONVEYORS. IN THE BACKGROUND IS THE SAND WIZARD CLEANING MACHINE.

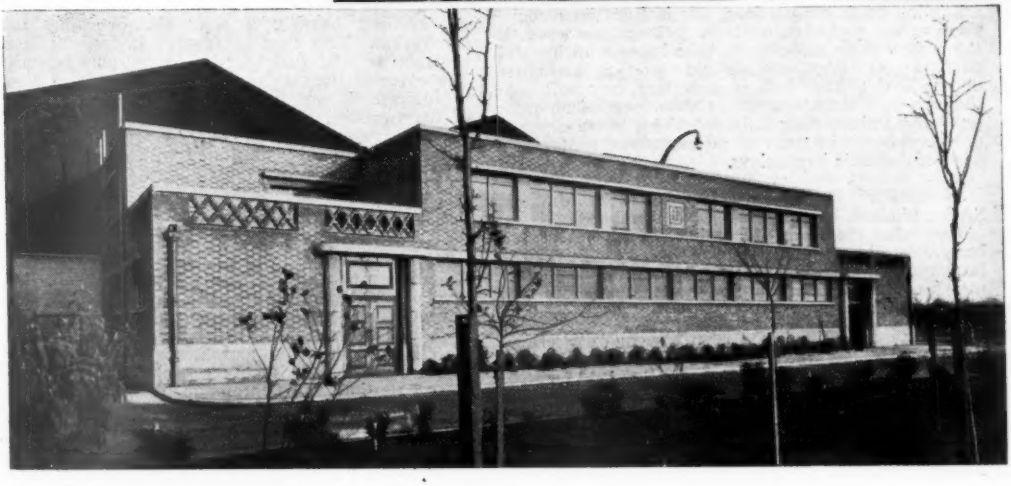


FIG. 20 (BELOW).—EXTERNAL VIEW OF THE BEEVOR FOUNDRY AMENITIES BLOCK, WHICH FRONTS ON TO THE APPROACH ROAD. THIS IS THE ONLY DOUBLE-STOREY BUILDING.

Institute of Vitreous Enamellers

Winter Meeting

On Wednesday of last week there was held, in London, the winter meeting of the Institute of Vitreous Enamellers. About 70 members and guests participated—a large contingent travelling from the Midlands. The late morning was spent at the Charing Cross Hotel in technical session, at which a Paper, "Cobalt and Nickel in the Vitreous Enamelling Industry," by J. E. Hanson, B.S., was read by Mr. Priddey. (The Author is a past-president of the American Ceramic Society.)

The Paper first discussed the general application of compounds of the two elements in enamel production and then enumerated the various theories to account for the increased adherence of enamels when these compounds were used. The concluding section dealt with the history of the development of nickel dips also for promoting enamel adherence and the adoption of this method for the production of one-coat enamels. The short discussion which followed, initiated by the chairman, Mr. C. P. Stone, was concentrated particularly on the mechanism of the improved adherence due to nickel and cobalt and the pros and cons of the theories advanced.

Luncheon was held at the Charing Cross Hotel and thereafter there was a works visit travelling being by motor-coach to the E.M.I. Factories, Limited, at Hayes, Middlesex. Here. the visitors were conducted by experienced guides through the press-shops, woodworking department, gramophone record section, pickling and plating shops and, finally, to the vitreous-enamelling department. In this self-contained plant examples of enamelware were on view and much interest was focused on the infra-red, gas-fired, tunnel-type drying ovens.

Tea was provided by the hosts and thanks were expressed on behalf of the visitors by Mr. C. P. Stone and responded to by Mr. H. W. Bowen, managing director of E.M.I. Factories, Limited.

House Organs

Tandem News, March, 1950. Issued by the Eyre Smelting Company, Limited, Merton Abbey, London, S.W.19.

The most interesting feature of this issue is an article on trade associations, for it lists the associations to which the issuing house belongs and why. It shows how these associations have become an integral part of modern business life and that their usefulness under existing conditions is such that they will continue in ever-increasing strength so long as no price regulation vitiates their activities. This house organ is produced in the interests of customers and contains no news of domestic happenings.

"Emm-Ess" Gossip No. 178. Issued by Matthew Swain, Limited, Newton Heath, Manchester, 8.

This takes the form of a mimeographed sheet and has for its object the detailing of works events for the benefit of the employees. It covers committee membership, instructional film shows, football results, and so forth.

WE REGRET THAT owing to what is technically termed "a dropped line," the paragraph in last week's issue announcing staff changes at Foundry Services, Limited, read incorrectly and gave the wrong impression. The position is clarified by stating that Mr. R. A. Miller will continue to deal with technical foundry problems, whilst Mr. R. D. Hume will be mainly concerned with production.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

VITREOUS ENAMELS FOR ALUMINIUM

To the Editor of the FOUNDRY TRADE JOURNAL

SIR,—We note on page 127 in the February 2 issue a short article on the vitreous enamelling of light-alloy castings. This article makes reference to the testing of such enamels that has been going on in the laboratories of this Association and it might be thought that your published statement originated from here. We would point out that this was not the case and draw attention to one error in the penultimate paragraph which may be of importance. Reference is there made to the good resistance to alkalis possessed by vitreous-enamelled aluminium. In our experience this has not been so, and there is undoubtedly considerable room for improvement before the enamels could be used for kitchen sinks.—Yours, etc.,

MARJORIE WHITAKER,
Investigator,
British Non-ferrous Metals
Research Association.

March 10, 1950.

[Further enquiries indicate that the statement in the original article was of a general character suggesting lines on which vitreous enamel finishes for aluminium *might* be developed. Considered from the viewpoint of a finish for aluminium, tests indicate that vitreous-enamelled components have a quite good resistance to the usual domestic alkalis, but that the enamel *per se* should not be compared with such special alkali-resistant enamels as have been developed for iron and steel.—Editor.]

New Catalogue

Electric Furnaces. The General Electric Company, Limited, Magnet House, Kingsway, London, W.C.2, have produced a new catalogue covering an extremely wide range of electric furnaces. Most of the types shown are for heat-treatment processes and the only melting plant included is for lead. A feature of most of the furnaces is the attention given to handling either by conveyorised hearths, a turntable, or some other mechanism. This class of furnace is growing in importance as solid fuel becomes increasingly expensive. The cover of the catalogue has been produced in red, to indicate, it can be presumed, the internal aspect of the furnaces. It is certainly very attractive. The brochure, which has an 8-in. wide by 6¼-in. deep format, is prolifically illustrated with clear pictures.

Raw Material Surveys

The Purchasing Officers' Association, Wardrobe Chambers, 146, Queen Victoria Street, London, E.C.4, have published three pamphlets which form part of a collection made under the general heading of Raw Material Survey Series. The first, price 3s., is "Raw Materials of the Iron and Steel Industry," by Mr. A. K. Osborne. This covers, alphabetically, a wide range, starting with chromium and finishing with vanadium. The second pamphlet covers Petroleum and is written by Mr. George Sell and costs 1s. 6d. The subject of the third one is Animal Feeding Stuffs, by Mr. H. R. Humphries. This, too, costs 1s. 6d.

Institute of Welding

The Spring Meeting of the Institute of Welding is to be held in Birmingham and Wolverhampton from April 25 to 28. The programme begins on the first day with a conference of branch officers at the Grand Hotel, Birmingham, followed in the evening by a Civic Reception at the Council House.

On Wednesday, April 26, 1950, Birmingham, the second day, there are technical Papers at the Grand Hotel in the morning and a selection of technical visits in the afternoon, including the following works: General Electric Company, Limited; Joseph Lucas (Electrical), Limited, and Metropolitan-Cammell Carriage & Wagon Company, Limited. At 6.30 p.m. there will be a brains trust meeting at Grand Hotel.

Thursday, April 27, 1950, will be spent in Wolverhampton, and technical Papers will be presented during the morning at the Victoria Hotel. In the afternoon there will be works visits to John Thompson (Wolverhampton), Limited, and Thompson Bros. (Bilston), Limited. In the evening a dinner will be held at the Grand Hotel, Birmingham, at which the Lord Mayor and Lady Mayoress of Birmingham (Alderman and Mrs. H. Humphreys) have kindly consented to be the principal guests.

In the morning of Friday, April 28, there will be a visit to The Austin Motor Company, Limited. A full programme has also been arranged for ladies attending the conference.

Increased Productivity

While it was true that Britain's economic position was largely a legacy of the war, the situation had to be faced that productivity per man was much less than that of America, and must be increased if the nation was to maintain its standard of living, said Prof. H. F. Humphreys, vice-principal of Birmingham University, at the yearly meeting of the University Court of Governors at Edgbaston. This could only be achieved by a much greater application of science to industry—and that was where universities were concerned.

A note on the subject had been issued by the University Grants Committee, he said, and this pointed out that, if industry were more or less stable and its techniques largely standardised, it might be able to manage with recruits from technical colleges and apprenticeship systems. With the far-reaching developments in fundamental science, however, graduates of high technical ability must be produced.

Prof. Humphreys stated that there was also the problem of providing post-graduate training. Graduates who had entered industry should be able to return to university from time to time to refresh themselves and be brought up to date with advances in science.

Fourth World Power Conference

Applications for membership of the Fourth World Power Conference, to be held in London from July 10 to 15, 1950, can still be accepted. Copies of the provisional programme and application form for membership can be obtained from the offices, at 414, Cecil Chambers, 76, Strand, London, W.C.2.

Some of the post-conference study tours, arranged for the week beginning July 17, are now full up, but there are still vacancies in certain of these tours, and also in the day and half-day excursions from London which will take place during the same week.

Ferro-Alloys in Stainless Steelmaking

One of the advantages which the use of the oxygen lance may give to the maker of stainless steels is the fact that, at the conclusion of the refining period, the bath in the electric-arc furnace has been made extremely hot, and under these conditions an appreciable recovery of the chromium oxidised during refining is possible. In present-day practice, this is normally carried out by the addition of ferro-silicon (usually 7.5 per cent. Si) to the bath, which alloy reacts with the slag and causes some of the Cr_2O_3 present to be reduced, while the silicon itself is oxidised to SiO_2. This is, of course, a modern application of the old Hamilton-Evans process of stainless-steel manufacture where a high-chrome slag was built up over a heat of low-carbon steel, using lime and chrome ore for the purpose, the chromium being then reduced into the steel by the use of ferro-silicon.

Chromium Recovery from Slag

Broadly speaking, this use of ferro-silicon after the bath has been subjected to oxygen-lance treatment may recover about 2 per cent. of chromium from the slag. If the charge when blowing commences contains only 12 per cent. Cr or under and a 12 per cent. Cr steel is to be tapped, this use of ferro-silicon as described may often obviate completely the use of any virgin chromium as ferro-chrome. The loss of chromium when blowing a 12 per cent. Cr heat with oxygen is frequently under 2 per cent., and may all be recovered with ferro-silicon. Where 18 per cent. Cr steels are to be produced, however, this is not possible. After treatment with ferro-silicon, there is usually some 2 to 3 per cent. more chromium required in the bath, and this has normally to be made up with low-carbon ferro-chrome.

In the latter connection, we understand from B.I.S.R.A. that the near future may well see the introduction of a new commercial alloy, ferro-silicon-chrome, which consists of roughly 50 per cent. Si, 37 per cent. Cr and 13 per cent. Fe, the carbon content being less than 0.06 per cent. The use of this alloy in stainless-steel manufacture should enable the operations of reducing the slag with ferro-silicon and then making up the remainder of the chromium content to be run into one, with a valuable saving in time, particularly as the furnace structure and hearth are subjected to extreme conditions of temperature during this period. With the use of ferro-silicon-chrome, the slag is reduced and the steel is re-chromised, simultaneously.

Development of London's Industry

The London Chamber of Commerce has despatched a *questionnaire* to about 6,500 manufacturers in the county of London in order to secure information which will help the London County Council in drawing up the plan upon which all future development of the county will be based. The questions are concerned with the nature of the business, floor area occupied, situation, and number of workers. They ask whether the premises are satisfactorily located, and, if not, what conditions are required, whether extensions or removals are desired, what methods of transport are used for inward and outward goods traffic, and whether these are adequate. The existence of a sports ground is also inquired into.

The information will go direct to the LCC, and while the plan is in the formative stage close liaison will be maintained between the Council and the London Chamber of Commerce land replanning committee, on which serve representatives of the Federation of British Industries (London and South-Eastern region).

News in Brief

THE 1949 JAMES CLAYTON PRIZE has been awarded by the Institution of Mechanical Engineers to Mr. C. C. Pounder.

UNDER A SPANISH-GREEK trade agreement providing for the exchange of goods on each side to a value of $2,000,000, signed in Madrid recently, Spain will export machinery, chemical products, etc.

THE MELTING SHOP of the Appleby-Frodingham branch of the United Steel Companies, Limited, created a new weekly ingot-output record recently by producing 15,871 tons. This is an increase of 605 tons over the previous best achieved in August last year.

THE CONTINUOUS steel wire-rod rolling mill at the Cardiff works of Guest, Keen & Nettlefolds (South Wales), Limited, rolled its two-millionth ton of steel wire rods and coils last Friday. Operating for 24 hours a day on the three-shift system, the mill employs a total of 219 men, an average of 70 per shift.

ORDERS valued at over £150,000 have been secured by L. Sterne & Company, Limited, Glasgow, for the supply of domestic and commercial refrigerators for the South American market. The major portion of the contract is for 2,500 units of ½ hp., while the balance is made up of standard machines ranging from ¼ hp. to 7½ hp.

G. & J. WEIR, LIMITED, Cathgart, Glasgow, S.4, have received an order for evaporating and distilling plant valued at U.S. $500,000 from the Government of the Dutch West Indies. This is the second order of the kind received by the company within two years, and it follows the recent visit of a senior executive of the company to the islands.

SHEFFIELD ENGINEERING TRADE TECHNICAL SOCIETY has decided to split into two groups because it is too unwieldy in its present state. Members will be given the choice of joining either the Technical Society of Engineering Production or the Technical Society of Engineering Maintenance. The number of lectures in the winter programme of the original society is to be increased to provide for subjects on maintenance.

THE GENERAL ELECTRIC COMPANY, LIMITED, Magnet House, Kingsway, London, W.C.2, have designed and are now producing a new electric domestic cooking oven. While retaining the modern lines of its predecessor, it has a much stronger construction. The main framework consists of two castings (hob and one-piece front frame) supporting heavy-gauge steel pressings. The drop-down door, introduced by the G.E.C. in their DC.113 model, has proved so popular that it has been continued in an improved form by the addition of a solid cast-iron frame.

THE STEEL COMPANY OF WALES, LIMITED, have announced that with effect from March 1, 1950, Mr. Luther Griffiths is chief engineer of the Steel Division. Formerly Mr. Griffiths was chief engineer of Port Talbot and Margam works, whereas in his new appointment he will be in charge of the engineering department of Port Talbot, Margam and Abbey works and Cornelly quarry. Mr. Griffiths, who gained his early engineering experience at Ffrwd Ironworks and the Westminster Coal and Coke Company, at Wrexham, and afterwards at the Brymbo Steel Company, came to Port Talbot in 1931. In 1935 he was appointed chief engineer of Port Talbot and Margam works. In recent years he has, in addition to being in charge of maintenance, been responsible for the reconstruction which is being carried out at Margam in order to make the works an integral part of the Abbey works project. The task of enlarging this existing works has been made more formidable by the fact that the reconstruction has had to be carried out without interfering with production.

February's Steel Production Record

The British steel industry established another new output record in February, when production was at an annual rate of 16,898,000 tons. The previous best annual rate—16,409,000 tons—was achieved in May, 1949. In February of last year, output was at an annual rate of 16,176,000 tons, which was then the highest rate in the history of the industry.

In the opening month of the year, steel output was at an annual rate of 15,873,000 tons, which was the highest ever achieved in the month of January, so that the average rate of production in the first two months of the year is 16,385,500 tons. The British Iron and Steel Federation, announcing the latest returns of the industry, says that, taken together, the January and February output figures may be regarded as an encouraging start to 1950.

Welsh and Scottish Records

Production units in both South Wales and Scotland returned record output rates last month. The annual rate of production in South Wales in February was 3,493,000 tons, compared with 3,439,600 tons in the previous month, which was also a record, and 3,288,300 tons in February, 1949.

The annual production rate of steel output in Sotland last month was 2,632,400 tons, against 1,857,300 tons in the opening month of the year, which, as usual, was affected by holidays, and 2,539,700 tons in February, 1949.

February pig-iron output was at an annual rate of 9,588,000 tons, compared with 9,742,000 tons in January and 9,422,000 tons in February, 1949.

The latest steel and pig-iron output figures (in tons) compare as follow with earlier returns:—

	Pig-Iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
1950—January ..	187,400	9,742,000	305,300	15,873,000
February ..	184,400	9,588,000	325,000	16,898,000
1949—January ..	178,100	9,262,000	288,500	15,002,000
February ..	181,200	9,422,000	311,100	16,176,000

Shipbuilders' Developments

Speaking at the launch of the Shaw Savill & Albion Company's latest 13,000-ton refrigerated cargo liner Suevic, Sir Frederick Rebbeck, chairman of Harland & Wolff, Limited, Belfast, said that negotiations had been completed and an agreement would shortly be signed between the company and the Cooper Bessemer Corporation, of Mount Vernon, U.S.A., under which Harland & Wolff, Limited, would manufacture all the American company's specialised products for the whole of the sterling area. Production would cover air compressors, engines, and other equipment. A team of experts would be leaving for New York immediately to study the American firm's production methods.

Sir Frederick also disclosed that Harland & Wolff, Limited, were taking over additional premises in Belfast for the production of electric alternators, of which there was a world shortage. "Our purpose is to provide as many alternative activities as possible in view of the fact that shipbuilding orders are falling."

Results of Research

In his summing up of the first two addresses at the one-day symposium on "University Research and Industrial Practice," recently organised by the Industrial Liaison Committee of the University of Edinburgh, Sir Edward Appleton, F.R.S., principal of the University, said that scientists should make "popular" copies of their discoveries, as well as their own scientific originals. He quoted the case of one scientist whose discoveries were so veiled that the reader got the impression that the author had said to himself, "Here is the truth—let us hide it."

Dealing with criticisms that university research had no practical value, Prof. R. N. Arnold, of the Chair of Engineering at the University, said that some critics had even gone so far as to suggest that a university investigator gave up a line of research as soon as he began to suspect that it had some contact with reality. He pointed out that the immediate practical value of research work was not the measure by which it should be judged. The discoveries which mathematicians were making to-day would be put to practical use in the coming century.

The University welcomed co-operation with industry, and claimed the right to publish the results of its researches in the way it found most desirable for the good of the community. Scottish industry in general, he added, did not wholly appreciate the potential value of university training, and the fact that many English firms interviewed graduates in Scotland six months before graduation date for posts in their firms witnessed this.

Sir Andrew McCance, deputy chairman and joint managing director of Colvilles, Limited, emphasised that the universities had only begun to develop widely throughout the world when they exercised the function of producing results which had a direct effect upon the lives of men and women. The university people could show how to do a thing once, but to have a practical value a way must be found to do it thousands of times economically. That was the function of the industrialists.

Obituary.

MR. ANDREW MUNN, late of John Brown & Company, Limited, shipbuilders, etc., of Clydebank, died last Saturday.

MR. FREDERICK W. LEWIS, M.C., late managing director of the Perry Barr Metal Company, Limited, Great Barr, Birmingham, died on March 4, after a long illness.

MR. A. J. CHAPPELL, whose death is reported, had been the head of the engineering department of Constantine Technical College, Middlesbrough, from its opening in 1929.

Wills

WILLIAMS, F. C., late of Babcock & Wilcox, Limited, boilermakers, etc., of Renfrew	£3,715
SHARPLES, RICHARD, late managing director of William Allen (Manchester), Limited, brass and iron founders	£22,363
RICHARDSON, H. C., formerly a director of Ibbotson Bros. & Company, Limited, crucible-steel manufacturers, of Sheffield	£59,676
CHAMBERS, T. H. W., formerly a director of Gjers, Mills & Company, Limited, pig-iron manufacturers, of Middlesbrough	£27,776
GALLOWAY, C. J. A., a director and works manager of Keith Blackman, Limited, mechanical and electrical engineers, etc., of Tottenham, London, N.17	£14,059

Pure and Applied Science

The dividing line between pure and applied science must be a little vague, stated Sir James Peck, former Permanent Secretary of the Scottish Education Department, when he addressed the annual luncheon meeting of the Former Students' Association of the Royal Technical College, Glasgow, on March 4. Whether or not the technologies were ousted from the universities, he was certain that pure and applied science must be stable companions in any well-designed technical curriculum. He maintained that technology without its background of pure science and its stimulus from pure science must become barren and divorced from ultimate reality. Pure science should glance from time to time at its numerous offsprings in the world of practical politics, otherwise it might miss the stimulus which came from ministering to the needs of man in his struggle with an indifferent if not hostile environment.

The question of whether technological subjects should have an honourable place in the programme of a university or be segregated in special institutions of high status was more difficult to answer, said Sir James. Some people wanted to eject "the sprawling giant technology" on the ground that it was crushing the liberal studies, introducing an alien atmosphere, and burdening already overloaded institutions. Others held the view that technology, at least in its higher branches, was a fit associate for philosophy and the classics. It was held that students of both would gain mutually from this association. In effect, it was argued, a real university could not afford to cold shoulder a great body of human skill and knowledge.

"I am not at all sure," he said, "what is the answer to this question, but I should venture to say that I think the dividing line should be horizontal and not vertical. It should not be between the different subjects of human inquiry and action, but between the grades and standards of the subject. The line should be drawn with close regard to the ultimate aims of the students. That criterion might be applied to all subjects of repute."

£169,000 Award for Anodising Processes

A payment of £169,000 has been made by the Crown to Alumilite & Alzak, Limited, Brook Street, London, W.1, for inventions and secret processes used during the war for the protection of aluminium and aluminium alloys in the construction of aircraft. The award has been made without reference to the Royal Commission on Awards to Inventors and has been negotiated by Mr. A. J. Milne, managing director of the company. Mr. Milne stated that the Ministry of Supply Patents Branch in its letter to the firm described the award as being for "techniques and processes and information generally known as 'know-how'."

The processes, said Mr. Milne, are anodising and ancillary treatments, and at the beginning of the war they are stated to have prevented a serious hold-up of production because they enabled industry to do without chromic acid, which was imported.

To Visit America

It is pleasing to be able to announce that Mr. Noel P. Newman, J.P., president of the Institute of British Foundrymen, and Mr. Kenneth Marshall, M.A., director of the Council of Ironfoundry Associations, are to participate in the Annual Meeting of the American Foundrymen's Society which is being held at Cleveland from May 8 to 12.

Company News

The paragraphs below have been extracted from statements circulated to shareholders, speeches made at annual meetings, and other announcements.

J. & E. Hall, Limited:—The company's output last year was the highest ever achieved, says the chairman, LORD DUDLEY GORDON. "But our marine business, which forms a high proportion of our turnover, naturally fluctuates with shipbuilding," he adds. "As fewer refrigerated ships are being laid down, we can expect our output in future years to decline, and careful provision must be made for such an event." Considerable progress has been made in the development of quick freezing plants for shipboard use, including fish treatment. In the field of industrial refrigeration, the chairman says that plant supplied for the brewing industry, as usual, takes first place and is used for many different applications in that industry. Though the demand for plants for the quick freezing of fish has fallen off, the company has received important orders for this purpose and it seems likely that developments in this method of handling fish can be expected. The heavy crop of hard fruit last year resulted in a great increase in orders for cold-storage plants to deal with it. The dairy industry, as usual, has an important demand for refrigeration and 12 important plants were ordered during the year for this purpose. The usual quantity of orders was received and plants completed for various uses such as the chemical industry, air conditioning, bacon factories, and other applications in many industries. Lord Dudley Gordon adds that industrial refrigeration is obviously an important field for export work and, with the help of agents, the company has been very successful.

The lift and escalator department expanded its activities to the maximum permitted by the production resources available to it. The value of inquiries dealt with and orders booked increased by approximately 80 per cent. over the previous year. The value of export orders was maintained. Orders for ship lifts continued at a high level. The chairman says that escalators, both at home and for export, continue to offer scope for a widening market. A new type heavy-duty machine, intended primarily for railway application and vertical rises up to 80 ft., was produced. The first of such machines is now being manufactured for installation in the dome building at the Festival of Britain, 1951.

Crosthwaite Furnaces & Scriven Machine Tools, Limited:—During the past year the production of both machine tools and furnaces and stoker equipment has been good, says LORD RAMSDEN, the chairman. In fact, so far as the latter are concerned, developments at branch works have given increased space for production and now enable orders to be accepted on a larger scale and for quicker delivery. Every effort has been made to sell machine tools in foreign countries, and present export orders form a satisfactory proportion of the whole.

With regard to the future, Lord Ramsden says that, although there is still a reasonable order-book, new orders are not coming in as freely as in the past few years.

Ideal Boilers & Radiators, Limited:—The chairman, SIR HUBERT W. CARR, says that an expansion in output has been satisfactorily reflected in the year's results. The company has now completed the first step in the programme to extend the manufacturing facilities at Ideal Works, Hull, a new mechanised plant for the manufacture of baths having already commenced to operate. As a result of this development the company looks forward confidently to a further increase in turnover during the year 1950.

Demand for European Steel

Crude steel production last year in Europe, excluding the U.S.S.R., was 55,131,000 metric tons and was 7.8 million tons, or 16.5 per cent., higher than in 1948, according to figures laid before the Steel Committee of the United Nations Economic Commission for Europe. Pig-iron output, including blast-furnace ferro-alloys, was 40,444,000 metric tons, which was 5.4 million tons, or 15.5 per cent. above the level of 1948 production.

All the European countries except Belgium, Luxemburg, and Italy produced more crude steel than they did in 1948. Italian production was held back mainly by a shortage of hydro-electric power. In Belgium and Luxemburg lack of orders was the major reason for a falling-off in output from a yearly rate of nearly 8,000.000 tons in March, 1948, to some 5,000,000 tons in November, 1949.

The E.C.E. Secretariat estimates that, if the demand for European steel had been higher throughout 1949, some 2 to 3 million tons more crude steel would have been produced.

It is estimated that crude steel production in the U.S.S.R. rose from 16,500,000 metric tons during 1948 to 20,600,000 tons last year, while production of pig-iron and blast-furnace ferro-alloys increased from 14,000,000 metric tons to 16,700.000 tons in 1949.

The E.C.E. Secretariat estimates that a maximum of over 62 million tons of crude steel could be produced in 1950 by Europe, excluding the U.S.S.R., but the present trend of demand suggests that production is likely to be substantially below this figure.

Crude steel production in the United States last year dropped to 70,635,000 metric tons, compared with 80,415,000 tons in 1948; output of pig-iron and blast-furnace ferro-alloys was 49,169,000 tons, against 55,379,000 tons.

Mr. Léon Daum (France), director-general of the *Compagnie des Forges et Aciéries de la Marine et d'Homécourt*, was re-elected chairman of the Steel Committee at last week's meeting, while Mr. Frantisek Pokorny (Czechoslovakia), director of the Czechoslovak National Corporation of Metal Works, was re-elected vice-chairman.

West German Steel Output

Mainly owing to fewer working days, the iron and steel industry of Western Germany produced less in February than in the previous month. Production of pig-iron and ferro-alloys, which amounted to 697,384 metric tons in January, decreased to 671,401 tons, while the output of steel ingots and castings, which totalled 907,109 tons during January, was down to 900,178 tons in February.

As the daily average of steel production reached 37,507 tons in February (34,846 tons in January), it is claimed that the annual permitted rate of 11.1 million metric tons has already been reached.

Business continues to be satisfactory and increasing orders, necessitating smaller quotas to individual customers and longer delivery, are expected.

David Brown's Acquire S.A. Subsidiary

David Brown & Sons (Huddersfield), Limited, have further widened the scope of their manufacturing activities by the acquisition of a wholly-owned subsidiary in South Africa, namely, Precision Equipment (Pty.), Limited, at Benoni in the Transvaal. This company is additional to that of David Brown & Sons S.A. (Pty.), Limited, situated in Johannesburg, which has been in existence for several years, representing in South Africa and the Rhodesias the Group of Companies owned and controlled by David Brown & Sons (Huddersfield), Limited.

STANTON-DALE

REFINED PIG IRON

Designed to meet the demands of high quality castings, which are, strength, machineability and resistance to wear.

All these can be secured by using Stanton-Dale Refined Pig Iron in your cupolas.

The above illustration shows a group of castings made by Messrs. Goodbrand & Co. Ltd., Stalybridge, Cheshire.

PROMPT DELIVERY

THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM

Company Results

(Figures for previous year in brackets.)

SAUNDERS VALVE COMPANY—Interim dividend of 6% (same).

CLARKE, CHAPMAN & COMPANY—Dividend of 12½% (same).

MATHER & PLATT—Final dividend of 7%, making 11% (same).

ALFRED HERBERT—Final dividend of 10% (12%), making 20% (22%), tax free.

MUREX—Interim dividend of 4% on £2,000,000 as increased by 100% share bonus (7½%).

LONDON ALUMINIUM COMPANY—Final dividend of 10% (70%), making 40% (100%).

STEETLEY COMPANY—Final dividend of 9%, making 13% (same) on capital of £776,260 (£576,260).

CRITTALL-HOPE METAL WINDOWS (SOUTH AFRICA)—Interim dividend of 10% (same).

BRUSH ELECTRICAL ENGINEERING COMPANY—Final dividend of 6%, making 10% on doubled capital (same).

MIDLAND ELECTRIC MANUFACTURING COMPANY—Dividend of 12½% on the £450,000 capital as increased by a 200% bonus issue (dividend of 20% and bonus of 15%).

LEYLAND MOTORS—Interim dividend of 20% (15%), plus special distribution of 5%, without deduction of tax, out of profit on sale of assets (same); no final dividend will be recommended (same).

IDEAL BOILERS & RADIATORS—Trading profit for 1949, £879,601 (£772,532); net profit, after depreciation, taxation, etc., £453,296 (£374,664); final dividend of 7½%, making 15%, tax free (same); forward, £993,162 (£672,366).

FOSTER, YATES & THOM—Trading profit for the year ended September 30, 1949, £53,851 (£52,453); net profit, after depreciation, tax, etc., £17,050 (£14,753); to general reserve, £10,000 (£8,000); dividend of 5% (same); forward, £3,306 (£2,856).

LOBNITZ & COMPANY—Net profit for 1949, after depreciation, tax, etc., £56,885 (£21,425); credit for excess provision for taxation in previous years, £°5,700 (nil); to general reserve, £70,000 (nil); dividend of 8% (same); forward, £34,697 (£33,675).

NORTH BRITISH LOCOMOTIVE COMPANY—Available profit for 1949, after depreciation, tax, etc., £60,742 (£61,626); transferred from reserve for taxation to capital replacement and development reserve, being considered in excess of taxation requirements, £35,000; dividend of 5% (same); forward, £73,552 (£67,810).

GENERAL REFRACTORIES—Group trading profit for 1949, £465,251 (£487,337); net profit, after depreciation, tax, etc., £153,386 (£176,366), of which £117,728 (£133,970) is included in parent's accounts, and £35,658 (£42,396) retained by subsidiaries; to general reserve, £70,000 (£75,000); dividend of 12½% (same); forward, £84,216 (£81,175).

BRUCE PEEBLES & COMPANY—Trading profit for 1949, £248,093 (£180,700); net profit, after depreciation, tax, etc., £112,229 (£73,922); unrequired tax, nil (£10,000); to assets replacement reserve, £25,000 (same); contracts reserve, £55,000 (£45,000); dividend equalisation reserve, £15,000 (same); dividend of 10% (same); forward, £15,724 (£11,082).

BEANS INDUSTRIES—Trading balance to November 30, 1949, £188,235 (£157,872, plus interest of £438); balance, after depreciation, tax, etc., £57,561 (£43,651); net profit relating to 1947-48, £11,129 (nil); to benevolent fund, £5,000 (same); general reserve, £29,000 (£10,000); final dividend of 27½%, making 37½% (same); forward, £55,446 (£45,406).

CROSTHWAITE FURNACES & SCRIVEN MACHINE TOOLS—Income for 1949, £27,079 (£16,887); net profit, after depreciation, tax, etc., £8,710 (£5,601); to dividend of 5% and bonus of 7½% (previously 25% on smaller capital), £3,366 net (same); to advertising expenditure reserve, £3,000 (nil); general reserve, £1,273 (£1,000); forward, £5,565 (£4,494).

CLARKE, CHAPMAN & COMPANY—Trading profit for 1949, £498,392 (£446,870); net profit, after depreciation, taxation, etc., £172,098 (£156,270); to staff pensions reserve, nil (£20,000); general reserve, £25,000 (same); research and development, £30,000 (£40,000); dividend equalisation reserve, £50,000 (nil); dividend of 12½% (same); forward, £56,781 (£54,573).

TWEEDALES & SMALLEY (1920)—Trading profit for 1949, £462,290 (£444,990); net profit, before tax, £392,434 (£387,318); to taxation, £210,109 (£275,751); tax provisions not required, £56,000 (nil); transfer from internal reserve, being an adjustment on revaluation of stock, nil (£60,511 net); to Indian income tax, £13,130 (£7,346); deferred repairs, £10,000 (nil); net loss on sales of property and investments, £6,315 (£21,449); reserve fund, nil (£25,000); contingencies, £80,000 (£40,000); stock reserve, £50,000 (£15,000); research reserve, £15,000 (nil); final dividend of 15%, making 25% (same); forward, £81,343 (£79,338).

ENGLISH ELECTRIC COMPANY—Consolidated balance on trading account for the 53 weeks to December 31, 1949, £2,661,134 (£1,960,966 for year); net profit applicable to group, after depreciation, exclusive of land, contingencies, tax, etc., £709,194 (£595,968); to dividends by parent company, £266,174 (same); general reserve, £396,870 (£200,000); forward, £490,256 (£444,106). Parent company's balance on trading account for the 53 weeks to December 31, £2,110,647 (£1,456,860 for year); profit, after depreciation, exclusive of land, tax, etc., £638,571 (£535,027); final dividend of 6%, making 10% (same); to general reserve, £300,000 (£200,000); forward, £272,332 (£199,935).

INTERNATIONAL COMBUSTION (HOLDINGS) (formerly International Combustion)—Consolidated trading profit to September 30, 1949, £572,841 (£435,467); net profit attributable to International Combustion (Holdings), £239,628 (£183,716); profits retained in subsidiaries, £11,322 (£2,579); additional profit on contracts in previous years, nil (£116,876); to amount capitalised and utilised for issue of bonus shares, £27,547 (nil); available balance, £296,245 (£422,973); to general revenue reserve, £100,000 (£250,000); dividends—preference £4,950 (same), ordinary of 21% (37½% on smaller capital), £72,537 (same); forward—International Combustion (Holdings) £118,758 (£95,486), subsidiaries £14,776 (£3,454), group £133,534 (£98,940).

STEEL COMPANY OF WALES—Consolidated accounts to October 1, 1949, show trading profits, £2,112,728 (£1,486,523 for 53 weeks); dividend receivable on investment in a partly-owned subsidiary merchanting company, not consolidated (profits for period applicable to holding company's shareholding), £1,137 (£1,755); bank interest, etc., £9,031 (£35,648); to auditors' remuneration, £3,500 (£3,200); debenture interest, £448,767 (£358,039); loan interest (Finance Corporation for Industry), £37,767 (nil); depreciation and furnace renewals, £692,286 (£555,829); leaving £940,576 (£606,858, less £12,324 written off in a subsidiary's accounts in respect of premium on shares in another subsidiary); to dividend of 4% (at the rate 4% per annum), £268,093 (£272,962); forward (Steel Company of Wales), £994,055 (£321,572).

New Patents

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 2s. each. The numbers given are those under which the Specifications will be printed, and all subsequent proceedings will be taken.

625,769 MORTON, J. A., ANDREW, J. H., and PROTHEROE, H. T. Manufacture of iron, steel, and non-ferrous castings.

625,775 MORTON, J. A., ANDREW, J. H., and PROTHEROE, H. T. Manufacture of iron, steel, and non-ferrous castings.

625,833 BRITISH THOMSON-HOUSTON COMPANY, LIMITED, and SMEATON, T. F. Lubricant for use in wire drawing.

625,919 MASSE, T. J. Manufacture of metal shells by impact extrusion.

625,964 SAKLATWALLA, B. D. Alloy steels.

625,985 SYKES, C., THORNTON, A. E., and STOKES, C. Manufacture of discs, wheels and like articles from metals that are difficult to forge.

626,074 PNEULIC, LIMITED, and RUSSELL, W. Sand-blasting apparatus.

626,085 CASTELLI, C. Charging apertures for high-temperature furnaces.

626,107 BIRLEC, LIMITED. Alloying a metal with one or more heavier metals.

626,178 BRITISH CAST IRON RESEARCH ASSOCIATION, and MORROGH, H. Cast iron.

626,204 GRIFFITHS, W. T. Alloys for use at high temperatures.

626,239 IMPERIAL CHEMICAL INDUSTRIES, LIMITED, and BRITTON, J. W. Removal of stains and coatings from the surfaces of metals.

626,455 STEVENS, A. H. (American Cyanamid Company). Manufacture of silica alumina gels.

626,458 WATERBURY FARREL FOUNDRY & MACHINE COMPANY. Machine for making nut blanks.

626,548 TRIGGS, W. W. (Morgan Construction Company). Vertical rolling mills.

626,604 STEVENS, A. H. (Bransome, E. D.). Controlling the composition of steel alloys during manufacture.

626,668 COLIN & CIE. Oven for drying damp materials such as foundry moulds and cores.

626,723 CENTRAL FOUNDRY COMPANY. Annular grey cast-iron pipes and the like.

626,760 MORTON, J. A., ANDREW, J. H., and PROTHERCE, H. T. Manufacture of iron and steel castings.

626,906 NAAMLOOZE VENNOOTSCHAP PHILIPS' GLOEILAMPENFABRIEKEN. Process of casting metals.

626,983 BERK & COMPANY, LIMITED, F. W., JONES, W. D., YARSLEY, V. E., and MORDANT, D. F. Metallic castings.

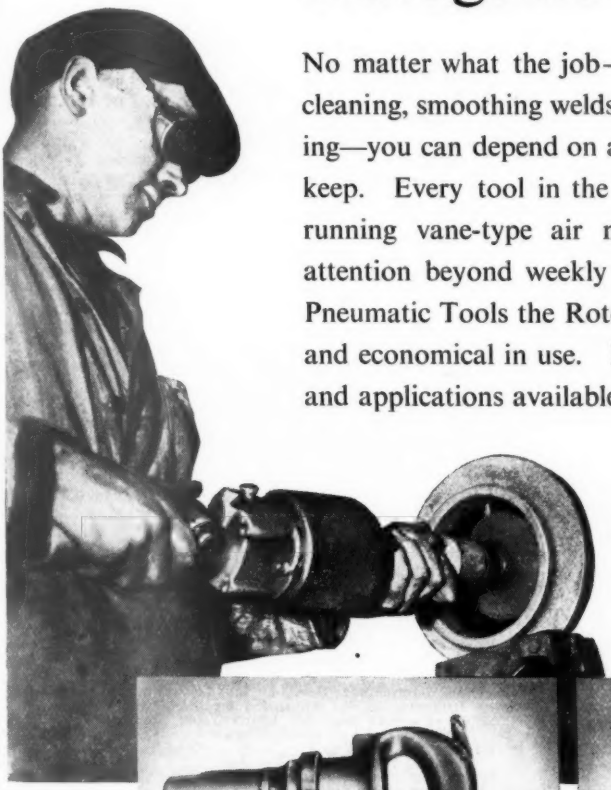
626,987 GAS LIGHT & COKE COMPANY, EATON, F. J., and NEWMAN, R. J. Solid fuel-fired heating appliances and back boilers for use therewith.

626,990 VLTAVSKY, V. Die-casting.

627,000 BALDWIN INSTRUMENT COMPANY, LIMITED, LOVE, A., and SIK, G. Apparatus for measuring the extension of ferro-magnetic material during the process of rolling.

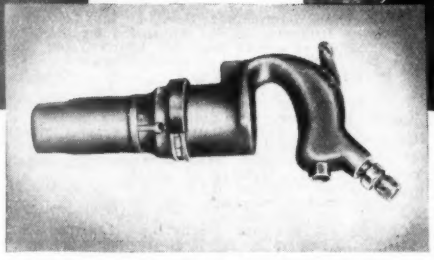
(Continued on page 304)

"Give me a Holman Rotogrind every time"

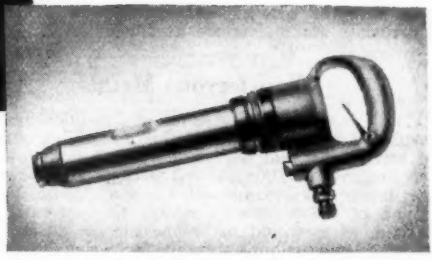


No matter what the job—whether it's grinding, fettling, cleaning, smoothing welds, die dressing or loco rod grinding—you can depend on a Holman Rotogrind to earn its keep. Every tool in the range is powered by a smooth-running vane-type air motor and requires very little attention beyond weekly lubrication. Like all Holman Pneumatic Tools the Rotogrind Series are easy to handle and economical in use. Full particulars of performance and applications available on request.

Size 2 Rotogrind—suitable for internal grinding, cleaning castings, etc. The range also includes precision grinding and heavy-duty types. "Straight" and "grip" handles available.



Pneumatic Hammer for chipping and caulking. Construction and action similar to riveters, and similar range in handles. Weight from 7¼ lb. to 13¾ lb.



Riveter. Weight from 12¾ lb. to 19¼ lb. Available with open or closed handle, inside or outside trigger, and usual snaps.

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H.25

Raw Material Markets

Iron and Steel

Due to the stoppage of the No. 2 blast furnace at the Clyde Iron Works of Colvilles, Limited, for relining, there was a shrinkage last month of 3,000 tons in the average weekly output of pig-iron. Sufficient stocks of basic iron have been accumulated to tide over the period until this stock is restored to active operation, but supplies of merchant iron are limited and leave no available margin for export. There is no special urgency in the demand for high-phosphorus iron and refined-iron makers can readily meet consumers' requirements, but production of hematite and low-phosphorus iron is readily absorbed and barely suffices to meet the current requirements of the engineering and speciality foundries, which are still busily engaged.

Imports of Belgian material are not, nor are they likely to be, suspended in the near future. But the requirements of the re-rolling industry have undergone a reduction and, as home outputs tend to expand, it is not surprising to discern a contraction in the imports of semi-finished steel from the Continent. Small-bar producers are experiencing the brunt of keen Continental competition and drastic price cutting. There are, however, regular outlets for the maximum production of sheet bars and slabs. Billets generally are in ample supply, but the smallest sizes are still wanted.

The plate mills are all working to capacity and in many instances have achieved new output records. But, even so, rollers have failed to overtake or even to keep abreast of the demand and there is certain to be a big overlap at the end of the period. Specifications for the lighter gauges are particularly numerous and, of course, the call for black and galvanised sheets continues to be overwhelming. Ministerial restrictions on capital expenditure are probably responsible for a slight shrinkage in the flow of new orders for heavy joists and sections, but there is still a lot of material to be rolled against orders already booked. There are, however, signs of keener foreign competition in light sections and small bars. Rail mills have substantial rolling programmes and so also have the wire and strip mills, while colliery requirements are maintained at a high level.

Non-ferrous Metals

The firmness of the three months' position in tin has continued, and the backwardation, for so long a feature of this market, has narrowed. Throughout last week the Eastern quotation showed strength and New York was firmer in sympathy with London. Complete elimination of the premium for cash tin is greatly to be desired, as it would make the market attractive for hedging transactions, thereby increasing the weekly turnover.

Metal Exchange tin quotations were as follows:—

Cash—Thursday, £599 5s. to £599 15s.; Friday, £598 15s. to £599; Monday, £596 to £598; Tuesday, £599 to £599 10s.; Wednesday, £599 10s. to £600.

Three Months—Thursday, £591 to £591 10s.; Friday, £592 10s. to £593; Monday, £587 to £588; Tuesday, £594 10s. to £595; Wednesday, £598 to £598 10s.

In contrast with the firmness in tin, the American lead price broke to 11 cents last Thursday and this was followed by a reduction of £9 in the UK quotation on the following day. It seemed as if the Ministry of Supply had some trouble in making up its mind about the amount of the adjustment, for the announcement of £88 as the revised level did not come till about midday. In view of the American price at 11 cents this figure of £88 is reasonable, but why, in the face of evidence that lead is no longer in short supply, the Ministry elects to maintain an allocation scheme for this metal is something of a puzzle. On Tuesday, a leading Customs smelter in the U.S.A. cut the price of lead by ½ cent. Spot New York was reduced from 11.00 to 10.50 cents, East St. Louis from 10.80-10.85 cents to 10.30-10.35 cents, and export from 10.50 cents nominal to 10.00 cents nominal.

An increase of £2 per ton in the U.K. zinc price was notified yesterday (Wednesday) morning. The Ministry of Supply's action follows a move in the U.S. levels on Tuesday from a uniform 9.75 cents per lb. to a split quotation of 9.75-10 cents. The U.S. price was later raised to 10 cents.

Last week saw brisk business in scrap, for a number of Ministry of Supply tenders were settled at prices which are believed to have been satisfactory from the seller's point of view. Old-metal quotations still show a tendency to rise, and brass swarf, often regarded as the "bell-wether" of the scrap market, has been particularly strong. Since our last report there has been an advance of ¼d. in the extruded brass-rod quotation, and it has been remarked before that an increase in brass rod appears to encourage a rise in the value put on swarf. It is now generally accepted that the Ministry has abandoned, for the present at any rate, its idea of selling to the highest bidder, a large accumulation of non-ferrous scrap. This, it is understood, will be cleared through the normal channel of sale by tender and it must be expected that the tempo of surplus disposals month by month will be raised. So long as consumers have confidence in the price level of the virgin metals no doubt everything will go along smoothly, but when the weakness now apparent in lead spreads to the other metals then disposal of scrap may not be so easy. Unless, of course, the Government has enough wisdom to reopen the free market. At the moment such a step seems to be unlikely.

New Patents

(*Continued from page* 302)

627,025 SHEFFBRIDGE COAL & IRON COMPANY, LIMITED, and BADDELEY, A. W. Apparatus for discharging liquid.
627,083 FOUNDRY SERVICES, LIMITED, and STRAUSS, K. Moulding of metal and metal alloys.
627,129 TRIGGS, W. W. (Morgan Construction Company). Vertical rolling mills.
627,148 BIRMINGHAM STEEL COMPANY, LIMITED. and BAYLISS, J. Domestic fire grates.
627,156 NATIONAL MALLEABLE & STEEL CASTINGS COMPANY. Car coupler.
627,432 GENERAL ELECTRIC COMPANY, LIMITED, and DONELAN, J. A. Welding of metal.
627,489 GRESHAM, H. E., and HALL, D. W. Heat treatment of nickel-chromium base alloys.
627,541 NORDSTROM, O. Furnace for burning sulphide ores.
627,678 FOUNDRY SERVICES, LIMITED, STRAUSS, K., and BODDEY, R. F. Heat producing mixtures containing aluminium and an oxidising agent.
627,744 INTERNATIONAL COMBUSTION, LIMITED, and ENNALS, E. G. Conveyor idlers.
627,792 BIRLEC, LIMITED. Induction furnaces.
627,806 MORGAN ENGINEERING COMPANY. Ingot stripping mechanism.
627,981 HAYNES STELLITE COMPANY. Alloys for high temperature use.
628,012 LOEWY ENGINEERING COMPANY, LIMITED, HENSCHKER, E. R., and SALTER, F. S. Ring rolling mill.

AT THE WEST WALES SECTION of Richard Thomas & Baldwins the total ingot output of the eight steel works for the week ending March 11 reached 18,954 tons, thus exceeding for the second successive week the all-time record for these works of 17,976 tons which had stood since 1937.